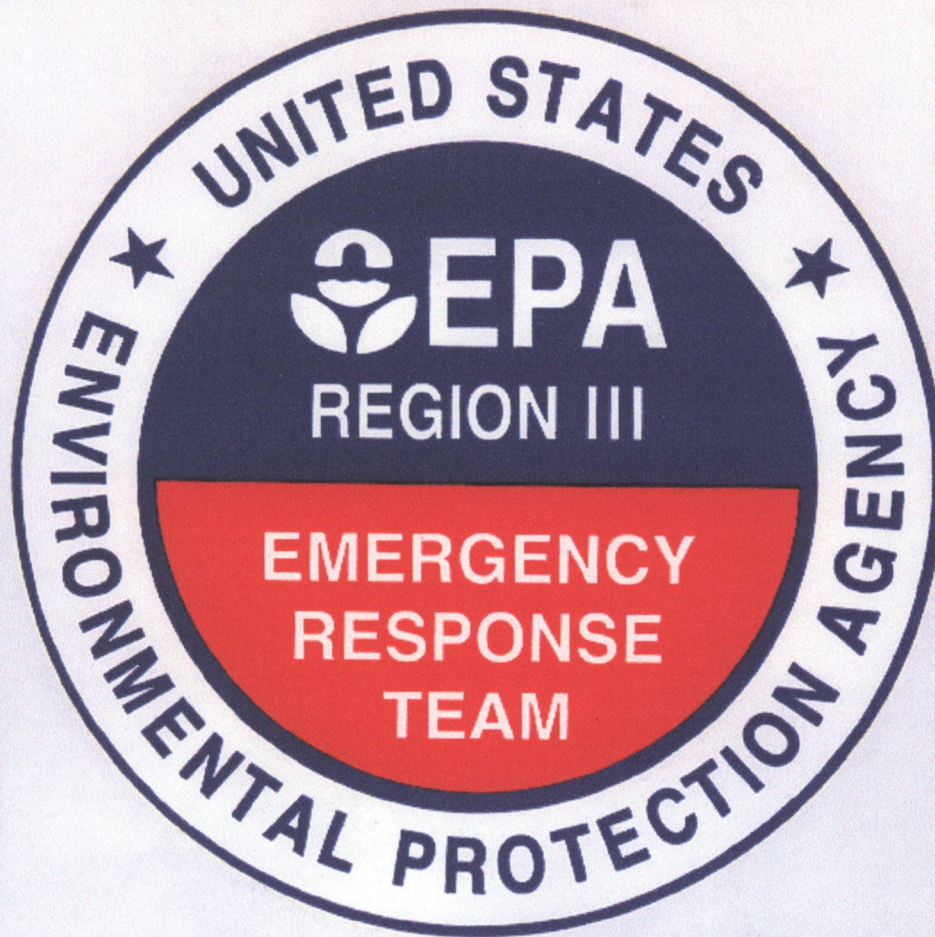


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*12th Street Dump/Landfill Site
Health and Safety Plan*



Michael Towle, OSC
U.S. EPA Region III
Philadelphia, PA



SDMS DocID

2229320

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12th Street Landfill/Dump Site Health and Safety Plan

EPA Contract: 68-S5-3002

TDD #: 0001-90

PCS #: 6269

On-Scene Coordinator: Michael Towle

START Site Lead: Sviatlana Wilson

ERRS Response Manager: James Crosby

START Site Safety Officer: Leigh DeHaven

ERRS Site Safety Officer: Enter ERRS SSO Name Here

Date of Initial Site Activity: 5 May 2000

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1.0 INTRODUCTION

1.1 Scope and Applicability of the Health and Safety Plan

The purpose of this Site Health and Safety Plan is to define the requirements and designate protocols to be followed at the 12th Street Landfill/Dump Site during investigation, removal and remediation activities. Applicability extends to all Government employees, contractors, subcontractors, and visitors.

All personnel on site, contractors and subcontractors included, shall be informed of the site emergency response procedures and any potential fire, explosion, health, or safety hazards of the operation. This HASP summarizes those hazards and defines protective measures planned for the site.

All personnel prior to entering the exclusion zone or contamination reduction zone must review this plan.

During development of this plan consideration was given to current safety standards as defined by EPA/OSHA/NIOSH, health effects and standards for known contaminants, and procedures designed to account for the potential for exposure to unknown substances. Specifically, the following reference sources have been consulted:

- OSHA 29 CFR 1910.120 and EPA 40 CFR 311
- EPA, OERR ERT Standard Operating Safety Guides
- NIOSH/OSHA/USCG/EPA Occupational Health and Safety Guidelines
- ACGIH Threshold Limit Values

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2.0 RESPONSIBILITIES

2.1 On-Scene Coordinator

The OSC, Under the National Contingency Plan, is responsible for overall project administration and coordinating Health and Safety Standards for all individuals on-site at all times. All U.S. EPA Health and Safety Guidelines and Requirements, as well as applicable OSHA Standards, shall be applied. However, each contractor (as an employer under OSHA), is also responsible for the health and safety of his employees. If there is any dispute with regards to health and safety, the following procedure shall be followed:

1. Attempt to resolve the issue on-site.
2. If the issue cannot be resolved on-site, personnel shall consult off-site supervisors for assistance and the specific task operation in dispute shall be discontinued until the issue is resolved.

2.2 START Site Leader

1. The START Site Leader is responsible for the following:
2. Making certain that personnel under his/her direction and oversight receive and are aware of the provisions of this HASP, are instructed in the work practices necessary to ensure safety, and are familiar with planned procedures for dealing with emergencies;
3. Assuring the completion of HASP acceptance forms;
4. Proposing any modification to the HASP to the RSO for approval;
5. Making certain all field personnel are in compliance with the hazardous waste worker health and safety training and medical surveillance requirements of 29 CFR 1910.120;
6. Correcting any work practices or conditions that may result in injury or exposure to hazardous substances; and
7. Preparing any accident and routine job exposure forms.

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2.3 Response Manager (RM)

The RM, as field representative for the ^{ERR}ERCS clean-up contractor, has the responsibility for fulfilling the terms of the delivery order. The RM must oversee the project and ensure that all technical, regulatory, and safety requirements are met. It is the RM's responsibility to communicate with the OSC as frequently as dictated by the OSC regarding site clean-up progress and any problems or injuries encountered.

2.4 Site Health and Safety Officer

The HSO is responsible for the following:

1. Developing or reviewing action-specific plans that may become necessary based on unforeseen field conditions for use by ^{START}~~SATA~~ personnel or their subcontractors;
2. Implementing the action-specific plans and reporting to the ^{START}~~SATA~~ Site Leader if there are any deviations from the anticipated conditions described in the HASP;
3. Resolving site disputes involving health and safety issues;
4. Assuring the implementation of the HASP by on-site personnel;
5. Updating and modifying the HASP as site or environmental conditions change, in consultation with the ^{START}~~SATA~~ Site Leader and RSO;
6. Conducting periodic inspections to determine if the HASP is being followed;
7. Stopping work at any time, if warranted, due to unsafe conditions, and notifying the ^{START}~~SATA~~ Site Leader of any Stop Work Orders issued;
8. Monitoring on-site hazards and conditions;
9. Making certain that all monitoring equipment is operating correctly and is maintained according to manufacturer's instructions;
10. Calibrating all monitoring equipment on a daily basis and recording results on the appropriate forms;
11. Conducting safety briefing and site-specific training for on-site personnel;
12. Selecting personal protective equipment (PPE) in consultation with the ^{START}~~SATA~~ Site Leader and RSO;
13. Inspecting PPE; periodically:

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14. Ensuring that PPE is properly stored and maintained;
15. Defining limited access zones on a daily basis;
16. Monitoring on-site project personnel for signs of stress, such as cold exposure, heat stress, and fatigue;
17. Coordinating emergency care, evacuation, rescue, etc.;
18. Investigating all accidents, illnesses and incidents occurring on the site;
19. Enforcing the "buddy system"; and
20. Providing briefing on health and safety issues and escorting agency (e.g., federal, state, or local government) personnel and visitors visiting the site.

2.5 Corporate or Regional Safety Officer

The RSO is responsible for the following:

1. Reviewing and approving the HASP and any proposed modifications;
2. Conducting site inspections to determine if the HASP is being followed; and
3. Resolving site disputes involving health and safety issues, if the disputes could not be resolved at the HSO level.

2.6 Other Site Personnel

Project personnel responsibilities include the following:

1. Reading, understanding and complying with the HASP;
2. Taking all reasonable precautions to prevent injury to themselves and to their fellow employees;
3. Performing only those tasks that they believe they can do safely, and immediately reporting any accidents and/or unsafe conditions to the HSO and ~~SATA~~ ^{START} Site Leader; and,
4. Notifying the HSO and ~~SATA~~ ^{START} Site Leader of any special medical problems (e.g., allergies) and making certain that all on-site personnel are aware of any such problems.

3.0 SITE INFORMATION

3.1 Site Address

Street Address: 12th Street
City: Wilmington
County: New Castle
State: Delaware
Zip Code: 19802

3.2 Site Contact Information

Site Contact Name: Michael Towle
Telephone Number: (215) 814-3272

3.3 Site Background

The 12th Street Landfill/Dump Site (Site) consists of an abandoned dump containing industrial materials. The Site is located immediately adjacent to the Brandywine Creek in Wilmington, Delaware. The site is bounded by an active railroad right-of-way, industrial activity, an interstate highway and open land characterized by marsh vegetation.

The contaminated soil fill at the Site contains industrial debris such as drums, industrial hoses, resinous materials and other items. The site was used as a storage facility of some sort for a hose manufacturing company.

3.4 Quantities and Types of Materials Present

1. Lead – Soil – Highest concentration is 206,000 mg/kg
2. Lead – Sediment – Highest concentration is 19,500 mg/kg
3. Lead – Subsurface Soil – highest concentration is 264,000 mg/kg
4. Arsenic
5. Copper
6. Zinc
7. Chromium
8. Barium
9. Phenol
10. Toluene

The amount of contaminated soil is estimated at over 19,000 yd³.

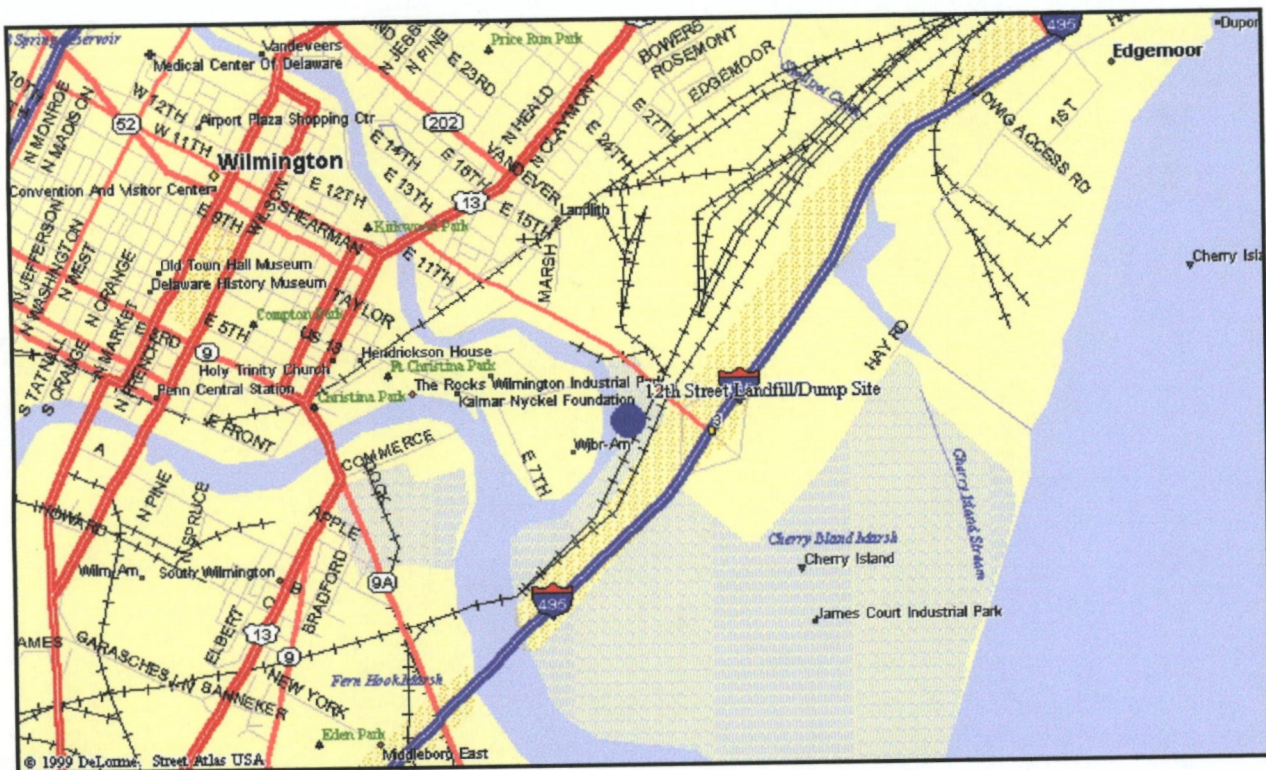
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3.5 Site Work Activities

1. Clearing of site.
2. Construct roads for improved site access as necessary.
3. Install perimeter fence.
4. Implement erosion control measures.
5. Excavate soil and sediment at site.
6. Install soil cover and regrade/restore site.

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Figure 1: Site Location Map



3.6 Directions to Site

- Interstate 95 South to Interstate 495 South.
- Exit at Exit 3 from Interstate 495. Site is to the left after exit bordering on Brandwine Creek.

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4.0 TASK/OPERATION SAFETY AND HEALTH RISK ANALYSIS

4.1 Site Reconnaissance/Assessment Activities

4.1.1 Site Walkthrough

Chemical Hazards 1. Lead 2. Cadmium 3. Phenol 4. Toluene 5. Arsenic 6. Barium	Protective Clothing Level of Protection "D"		Air Monitoring/Sampling Required
Physical Hazards 1. Slip/Trip/Fall 2. Work Near Water 3. Insects 4. Animals 5. Poisonous Plants	Cartridge Type N/A Type of Suit Tyvek (Tick Protection) Inner Glove N/A	Outer Glove Work Glove Foot Cover Leather Work Boot Special Requirements PFD	Particulate VOC γ Radiation

General hazards associated with Site Walkthrough activities include the following:

- Exposure to irritants and toxic plants, such as poison ivy and sticker bushes, may cause allergic reactions to personnel.
- Surfaces covered with heavy vegetation and undergrowth may create a tripping hazard.
- Surfaces covered by scrap metals and various debris may create tripping and injury hazards.
- Back strain may occur due to carrying heavy instruments improperly.
- In warmer weather, may present the possibility of insect bites and associated diseases such as Lyme disease and exposure to toxic plants, such as poison ivy.
- Native wildlife such as rodents, ticks, and snakes may present the possibility of insect bites and associated diseases such as Lyme disease.
- Driving vehicles on uneven or unsafe surfaces can result in accidents such as overturned vehicles or flat tires.
- Electrical hazard may occur due to fallen lines.

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- Heat stress/cold stress may occur due to exposure.
- On-site chemical hazards depending on contaminant location and contact or disturbances of contaminated areas.

Hazard Prevention

- Wear long-sleeved clothing and slacks to minimize contact with irritants and toxic plants and to protect against insect bites. Provide appropriate first aid for personnel's known allergic reactions.
- Be alert and observe terrain while walking to minimize slips and falls. Wear steel-toed boots provide additional support and stability.
- Use proper lifting techniques to prevent back strain.
- Ensure all maintenance is performed on vehicles before going to the field. Site surveillance on foot may be required to choose clear driving paths.
- Ensure fallen power lines are not energized.
- Avoid buildings that are not structurally sound.
- Implement heat stress management techniques such as adjusting work hours, consuming extra fluids, and monitoring employees, especially high risk workers.

4.1.2 Site Survey and Sampling Grid Layout

<p><i>Chemical Hazards</i></p> <p>7. Lead 8. Cadmium 9. Phenol 10. Toluene 11. Arsenic 12. Barium</p>	<p><i>Protective Clothing</i></p> <p>Level of Protection "D"</p>		<p><i>Air Monitoring/Sampling Required</i></p>
<p><i>Physical Hazards</i></p> <p>6. Slip/Trip/Fall 7. Work Near Water 8. Insects 9. Animals 10. Poisonous Plants</p>	<p><i>Cartridge Type</i> N/A</p> <p><i>Type of Suit</i> Tyvek (Tick Protection)</p> <p><i>Inner Glove</i> N/A</p>	<p><i>Outer Glove</i> Work Glove</p> <p><i>Foot Cover</i> Leather Work Boot</p> <p><i>Special Requirements</i> PFD</p>	<p>Particulate</p>

General hazards associated with site survey and sampling grid layout include the following:

- Exposure to irritant and toxic plants, such as poison ivy and sticker bushes, may cause allergic reactions to personnel.
- Surfaces covered with heavy vegetation and undergrowth may create a tripping hazard.
- Surfaces covered by scrap metals and various debris may create tripping and injury hazards.
- Back strain may occur due to carrying heavy instruments improperly.
- Native wildlife such as rodents, ticks, and snakes present the possibility of insect bites and associated diseases such as Lyme disease.
- Driving vehicles on uneven or unsafe surfaces can result in accidents such as overturned vehicles or flat tires.
- Electrical hazards may occur due to fallen lines.
- Heat stress/cold stress exposure.
- On-site chemical hazards depending on contaminant location and contact or disturbances of contaminated areas.

HAZARD PREVENTION

Prevent on-site accidents and illnesses by exercising the following precautions:

- Wear long-sleeved clothing and slacks to minimize contact with irritant and toxic plants and to protect against insect bites. Provide appropriate first aid for personnel's known allergic reactions.
- Be alert and observe terrain while walking to minimize slips and falls. Wear steel-toed boots provide additional support and stability.
- Use proper lifting techniques to prevent back strain.
- Avoid wildlife when possible. In case of an animal bite, perform first aid and capture the animal, if possible, for rabies testing. Perform a tick check after leaving a wooded or vegetated area.
- Ensure all maintenance is performed on vehicles before going to the field. A site surveillance on foot may be required to choose clear driving paths.
- Ensure fallen power lines are not energized.
- Avoid buildings that are not structurally sound.
- Implement heat stress management techniques such as shifting work hours, fluid intake, and monitoring employees, especially high risk workers.

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4.1.3 Perimeter Monitoring

Perimeter monitoring /Sampling with High Volume Devices may be implemented dependent upon visual observations and the success of on-site engineering controls.

<i>Chemical Hazards</i>	<i>Protective Clothing</i> Level of Protection "D"		<i>Air Monitoring/Sampling Required</i>
13. Lead 14. Cadmium 15. Phenol 16. Toluene 17. Arsenic 18. Barium			
<i>Physical Hazards</i>	<i>Cartridge Type</i> N/A	<i>Outer Glove</i> Work Glove	Particulate Hi-Volume TSP Sampler
11. Slip/Trip/Fall 12. Work Near Water 13. Insects 14. Animals 15. Poisonous Plants	<i>Type of Suit</i> Tyvek (Tick Protection)	<i>Foot Cover</i> Leather Work Boot	
	<i>Inner Glove</i> N/A	<i>Special Requirements</i> PFD	

Site boundaries clearly distinguish the "clean" off-site areas from the "contaminated" on-site areas; therefore, chemical contamination from the site should not be a hazard associated with perimeter and off-site monitoring.

Perimeter monitoring and off-site monitoring are performed once the site boundaries have been established. Hazards specific to perimeter and off-site monitoring include encounters with residents and non-project personnel. This is a unique hazard, in that untrained personnel prove to be a risk when performing any type of site work. Inquisitive and/or hostile persons may interfere with the monitoring/sampling effort, jeopardizing the safety of themselves as well as the safety of the field team.

HAZARD PREVENTION

To minimize public involvement in perimeter monitoring/off-site monitoring, the most effective preventative measure is to inform all interested parties. Notifying state and local police, the fire department, and any local/state governmental officials of the project's purpose and scope. This will allow those authorities to answer questions posed to them by local residents and the media by preparing statements on the projects purpose or by informing the public where to call for further information. Advanced notification will alleviate the work interruption and/or stoppage due to field personnel answering questions.

4.2 Site Mobilization/Maintenance Activities

4.2.1 Install Perimeter Security Fence

Chemical Hazards 19. Lead 20. Cadmium 21. Phenol 22. Toluene 23. Arsenic 24. Barium	Protective Clothing Level of Protection "D"		Air Monitoring/Sampling Required
Physical Hazards 16. Slip/Trip/Fall 17. Work Near Water 18. Insects 19. Animals 20. Poisonous Plants	Cartridge Type N/A Type of Suit Tyvek (Tick Protection) Inner Glove N/A	Outer Glove Work Glove Foot Cover Leather Work Boot Special Requirements PFD	Particulate VOC γ Radiation

Hazards generally associated with drum sampling include the following:

- Heavy machinery operation;
- Crushing or Pinch Hazards associated with hand tools or machinery;
- Uneven Terrain;
- Slip, trip and fall;
- Biological Hazards, such as poison oak, ivy, deer tick, and poisonous snakes;
- Underground/overhead utilities;
- Electrical shock;
- Air release of particulate matter;
- Steady or non-steady noise;
- Lifting of heavy fencing materials may lead to back injury/strain;
- Flying debris.

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HAZARD PREVENTION

Prevent on-site accidents and illnesses by exercising the following precautions:

- Pre-arranged hand signals or two-way radio communication may be utilized to facilitate communication between equipment operators and pedestrian. Pedestrian traffic will make eye contact with equipment operators, signal intentions and receive verification that equipment operator is aware of their presence and intentions while working around equipment.
- Before any piece of equipment is placed into service, it shall be inspected by a competent person and is certified in safe working order. Safe operating loads, speed and seating capacity are not to be exceeded.
- Personnel using hand tools shall familiarize themselves with their proper operation before use.
- Personnel should familiarize themselves with the operations area and clear the area of recognized slip, trip and fall hazards prior to initiation of the task. Open holes, trenches, impoundments and sumps will be barricaded prior to site operations.
- Personnel should use proper techniques when lifting loads, using two people or preferably equipment when lifting heavy loads.
- All personnel involved in operations should wear hearing protection in the form of earplugs, muffs or a combination of both.
- All personnel should wear cotton or leather work gloves when working with fencing materials in order to prevent cuts and abrasions when working with these materials.

4.2.2 Trailer Placement

<i>Chemical Hazards</i>	<i>Protective Clothing</i>		<i>Air Monitoring/Sampling Required</i>
25. Lead 26. Cadmium 27. Phenol 28. Toluene 29. Arsenic 30. Barium	Level of Protection "D"		
<i>Physical Hazards</i>	<i>Cartridge Type</i>	<i>Outer Glove</i>	Particulate
21. Slip/Trip/Fall 22. Work Near Water 23. Insects 24. Animals 25. Poisonous Plants	N/A	Work Glove	
	<i>Type of Suit</i> Tyvek (Tick Protection)	<i>Foot Cover</i> Leather Work Boot	
	<i>Inner Glove</i> N/A	<i>Special Requirements</i> PFD	

General hazards encountered during mobilization include the following:

- Driving vehicles and parking trailers on uneven surfaces creates a possibility of the vehicle rolling, getting stuck in mud or ditches. Accidents may occur due to flat tires or obstacles.
- Crushing or pinching hazard due to trailer placement.
- Several types of hazards can be associated with utility hook-up depending on the particular work activity. Construction of temporary poles for electrical and/or telephone lines can disturb potentially contaminated soils.

HAZARD PREVENTION

Prevent on-site accidents and illnesses by exercising the following precautions:

- Back strain can be prevented by frequent breaks in routine. Use slow even movements and proper lifting techniques (i.e., with the legs). Wearing work gloves will reduce the incidence of hand injury and blisters associated with hand scything.
- Dust suppression techniques, i.e., wetting the material with water, will reduce dust exposure.
- Proper vehicle maintenance will prevent avoidable vehicle breakdown in the field. In order to minimize accidents from uneven terrain, a site surveillance should be performed on foot to choose a clear driving path.

- Seatbelts should be worn at all times.
- At a minimum, all heavy equipment shall have the safety features outlined in OSHA 29 CFR 1910/1926 Subpart O.
- Heavy equipment operators should have proper training and experience and documentation of both. The general provisions of 1910/1926 would apply.
- Hazards associated with the particular utility would be anticipated and the subcontractor employer should undertake proper measures. General provisions of 29 CFR 1910/1926 Subpart K should be implemented in order to prevent electrical hazards.

4.2.3 Utility Hook-up

<i>Chemical Hazards</i>	<i>Protective Clothing</i>		<i>Air Monitoring/Sampling Required</i>
<ol style="list-style-type: none"> 1. Lead 2. Cadmium 3. Phenol 4. Toluene 5. Arsenic 6. Barium 	Level of Protection "D"		
<i>Physical Hazards</i>	<i>Cartridge Type</i>	<i>Outer Glove</i>	
<ol style="list-style-type: none"> 1. Slip/Trip/Fall 2. Work Near Water 3. Insects 4. Animals 5. Poisonous Plants 	N/A	Work Glove	
	<i>Type of Suit</i> Tyvek (Tick Protection)	<i>Foot Cover</i> Leather Work Boot	
	<i>Inner Glove</i> N/A	<i>Special Requirements</i> PFD	

General hazards encountered during mobilization include the following:

- Driving vehicles and parking trailers on uneven surfaces creates a possibility of the vehicle rolling, getting stuck in mud or ditches. Accidents may occur due to flat tires or obstacles.
- Crushing or pinching hazard due to a trailer placement.
- Several types of hazards can be associated with utility hook-up depending on the particular work activity. Construction of temporary poles for electrical and/or telephone lines can disturb potentially contaminated soils.

HAZARD PREVENTION

Prevent on-site accidents and illnesses by exercising the following precautions:

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- Driving vehicles, placing trailers, and collecting rubbish, on uneven surfaces creates a possibility of the vehicle rolling, getting stuck in mud or ditches, or of an accident due to flat tires or striking obstacles, and the vehicles.

Crushing or pinching hazard due to Dumpster placement.

HAZARD PREVENTION

Prevent on-site accidents and illnesses by exercising the following precautions:

- Dust suppression techniques, i.e., wetting the soil with water, will reduce dust exposure.
- Proper vehicle maintenance will prevent avoidable vehicle breakdown in the field. In order to minimize accidents from uneven terrain, site surveillance should be performed on foot to choose a clear driving path.
- Seatbelts should be worn at all times.
- At a minimum, all heavy equipment shall have the safety features outlined in OSHA 29 CFR 1910/1926 Subpart O.
- Heavy equipment operators should have proper training and experience, and documentation of both. The general provisions of 1910/1926 would apply.
- Hazards associated with the particular utility would be anticipated and the subcontractor employer should undertake proper measures. General provisions of 29 CFR 1910/1926 Subpart K should be implemented in order to prevent electrical hazards.

4.3 Multi-Media Sampling

4.3.1 Air Sampling/Monitoring

<i>Chemical Hazards</i>	<i>Protective Clothing</i>		<i>Air Monitoring/Sampling Required</i>
<ol style="list-style-type: none"> 1. Lead 2. Cadmium 3. Phenol 4. Arsenic 5. Zinc 6. Barium 7. Toluene 	<p>Level of Protection "C" dependent upon site conditions as determined by the SSO</p>		
<i>Physical Hazards</i>	<i>Cartridge Type</i>	<i>Outer Glove</i>	Particulate VOC Personal Air Sampler
<ol style="list-style-type: none"> 1. Slip/Trip/Fall 2. Work Near Water 3. Insects 4. Animals 5. Trenches 6. Confined Space 7. Heavy Equipment 8. Noise 9. Poisonous Plants 	GME-P100	Nitrile	
	<i>Type of Suit</i> Tyvek	<i>Foot Cover</i> Latex	
	<i>Inner Glove</i> Nitrile Surgical	<i>Special Requirements</i> PFD	

General hazards frequently encountered during air sampling and monitoring include:

- Electrical hazards as a result of power sources to run sampling pumps.
- Placing sampling pumps in elevated areas or areas where slip/trip and fall hazards exist.
- Hazards associated with ambient environment being sampled.
- Readings indicating non-explosive atmospheres, low concentrations of toxic substances, or other conditions may increase or decrease suddenly, changing the associated risks.
- Air sampling matrix solutions may be acidic or basic, causing a corrosive hazard, and broken glass collection tubes can cut hands if mishandled.

HAZARD PREVENTION

Prevent on-site accidents and illnesses by exercising the following precautions:

- Grounded plugs should be used when a power source is needed to reduce the hazard of electric shock.

- Generators or air pumps should be used in dry areas, away from possible ignition sources. Do not stand in water or other liquids when handling equipment. Electrical equipment shall conform to OSHA 1910.303(a), 1910.305(a), (f), (f)(3).
- Ground fault interrupters are used in the absence of properly grounded circuitry or when portable tools must be used in wet areas.
- Extension cords should be protected from damage and maintained.
- Air pumps should be placed within easy reach using an OSHA approved ladder, elevated platform or by placing the pump on a stake.
- Personnel should be thoroughly familiar with the use, limitations and operating characteristics of the monitoring instruments.
- Perform continuous monitoring in variable atmospheres.
- Use intrinsically safe instruments until the absence of combustible gases or vapors is anticipated.
- Proper protective clothing, such as gloves and goggles, should be used when handling corrosive substances. First aid and 15-minute eye wash kits should be available. Handle and store corrosives in appropriate areas.

4.3.2 Grid Layout

<i>Chemical Hazards</i>	<i>Protective Clothing</i>		<i>Air Monitoring/Sampling Required</i>
8. Lead 9. Cadmium 10. Phenol 11. Arsenic 12. Zinc 13. Barium 14. Toluene	Level of Protection "C" if site activities warrant.		
<i>Physical Hazards</i>	<i>Cartridge Type</i> GME-P100	<i>Outer Glove</i> Nitrile	Particulate
10. Slip/Trip/Fall 11. Work Near Water 12. Insects 13. Animals 14. Trenches 15. Confined Space 16. Heavy Equipment 17. Noise 18. Poisonous Plants	<i>Type of Suit</i> Tyvek (Tick protection)	<i>Foot Cover</i> Latex	VOC
	<i>Inner Glove</i> Nitrile Surgical	<i>Special Requirements</i> PFD	Personal Air Sampler

General hazards associated with site walk-through, site surveys, and sampling grid layout include the following:

- Exposure to irritant and toxic plants such as poison ivy and sticker bushes may cause allergic reactions to personnel.
- Surfaces covered with heavy vegetation and under growth create a tripping hazard.
- Back strain due to carrying instruments.
- Native wildlife such as rodents, ticks, and snakes present the possibility of insect bites and associated diseases such as Lyme disease.
- Driving vehicles on uneven or unsafe surfaces can result in accidents such as overturned vehicles or flat tires.
- Electrical hazard due to fallen lines.
- Heat stress/cold stress exposure.
- On-site chemical hazards depending on contaminant location and contact or disturbances of contaminated areas.

HAZARD PREVENTION

Prevent on-site accidents and illnesses by exercising the following precautions:

- Wear long-sleeved clothing and slacks to minimize contact with irritant and toxic plants and to protect against insect bites. Provide appropriate first aid for personnel's known allergic reactions.
- Be alert and observe terrain while walking to minimize slips and falls. Wear steel-toed boots provide additional support and stability.
- Use proper lifting techniques to prevent back strain.
- Avoid wildlife when possible. In case of an animal bite, perform first aid and capture the animal, if possible, for rabies testing. Perform a tick check after leaving a wooded or vegetated area.
- Ensure all maintenance is performed on vehicles before going to the field. A site surveillance on foot may be required to choose clear driving paths.
- Ensure fallen power lines are not energized.

ORIGINAL

- Avoid buildings that are not structurally sound.
- Implement heat stress management techniques such as shifting work hours, fluid intake, and monitoring employees, especially high risk workers.

4.3.3 Surface Soil Sampling

<i>Chemical Hazards</i>	<i>Protective Clothing</i>		<i>Air Monitoring/Sampling Required</i>
15. Lead 16. Cadmium 17. Phenol 18. Arsenic 19. Zinc 20. Barium 21. Toluene	Level of Protection "C" if site activities warrant and dependent upon site conditions as determined by the SSO		
<i>Physical Hazards</i>	<i>Cartridge Type</i> GME-P100	<i>Outer Glove</i> Nitrile	Particulate
19. Slip/Trip/Fall 20. Work Near Water 21. Insects 22. Animals 23. Trenches 24. Confined Space 25. Heavy Equipment 26. Noise 27. Poisonous Plants	<i>Type of Suit</i> Tyvek	<i>Foot Cover</i> Latex	VOC
	<i>Inner Glove</i> Nitrile Surgical	<i>Special Requirements</i> PFD	Personal Air Sampler

For the purposes of this hazard identification section, surface soil sampling will be considered any soil sampling completed by hand using a trowel, a split spoon, a shovel, a auger, or another type of hand-held tool. Hazards generally associated with soil and tailings/spoils sampling include:

- Contact with or inhalation of contaminants, potentially in high concentrations in sampling media.
- Back strain and muscle fatigue due to lifting, shoveling and auguring techniques.
- Contact with or inhalation of decontamination solutions.

HAZARD PREVENTION

Prevent on-site accidents and illnesses by exercising the following precautions:

- To minimize exposure to chemical contaminants, a thorough review of suspected contaminants should be completed and an adequate protection program should be implemented.

- Proper lifting (pre-lift weight assessment, use of legs, multiple personnel) techniques will prevent back strain. Use slow, easy motions when shoveling, auguring, and digging to decrease muscle strain.
- Material Safety Data Sheets for all decontamination solutions should be included with each Site Health and Safety Plan.
- First aid equipment should be available based on MSDS requirements.

4.3.4 Subsurface Soil Sampling

<i>Chemical Hazards</i>	<i>Protective Clothing</i>		<i>Air Monitoring/Sampling Required</i>
22. Lead 23. Cadmium 24. Phenol 25. Arsenic 26. Zinc 27. Barium 28. Toluene	Level of Protection "C" if site activities warrant and dependent upon site conditions as determined by the SSO		
<i>Physical Hazards</i>	<i>Cartridge Type</i>	<i>Outer Glove</i>	Particulate VOC Personal Air Sampler
28. Slip/Trip/Fall 29. Work Near Water 30. Insects 31. Animals 32. Trenches 33. Confined Space 34. Heavy Equipment 35. Noise 36. Poisonous Plants	GME-P100	Nitrile	
	<i>Type of Suit</i> Tyvek	<i>Foot Cover</i> Latex	
	<i>Inner Glove</i> Nitrile Surgical	<i>Special Requirements</i> PFD	

For the purposes of this hazard identification section, surface soil sampling will be considered any soil sampling completed by hand using a trowel, split spoon, shovel, auger, or other type of hand-held tool. Hazards generally associated with soil and tailings/spoils sampling include:

- Contact with or inhalation of contaminants, potentially in high concentrations in sampling media.
- Back strain and muscle fatigue due to lifting, shoveling and auguring techniques.
- Contact with or inhalation of decontamination solutions.

HAZARD PREVENTION

Prevent on-site accidents and illnesses by exercising the following precautions:

ORIGINAL

- To minimize exposure to chemical contaminants, a thorough review of suspected contaminants should be completed and an adequate protection program should be implemented.
- Proper lifting (pre-lift weight assessment, use of legs, multiple personnel) techniques will prevent back strain. Use slow, easy motions when shoveling, auguring, and digging to decrease muscle strain.
- Material Safety Data Sheets for all decontamination solutions should be included with each Site Health and Safety Plan.
- First aid equipment should be available based on MSDS requirements.

4.3.5 Soil Borings

<i>Chemical Hazards</i>	<i>Protective Clothing</i>		<i>Air Monitoring/Sampling Required</i>
29. Lead 30. Cadmium 31. Phenol 32. Arsenic 33. Zinc 34. Barium 35. Toluene	Level of Protection "C" if site activities warrant "D" at site perimeter, mudflats and all non-contaminated fill areas		
<i>Physical Hazards</i>	<i>Cartridge Type</i> GME-P100	<i>Outer Glove</i> Nitrile	Particulate VOC Personal Air Sampler
37. Slip/Trip/Fall 38. Work Near Water 39. Insects 40. Animals 41. Trenches 42. Confined Space 43. Heavy Equipment 44. Noise 45. Poisonous Plants	<i>Type of Suit</i> Tyvek	<i>Foot Cover</i> Latex	
	<i>Inner Glove</i> Nitrile Surgical	<i>Special Requirements</i> PFD	

Hazards generally associated with drilling operations include the following:

- Noise levels exceeding the OSHA PEL of 90 dBA are both a hazard and a hindrance to communication.
- Fumes (carbon monoxide and/or oxides of nitrogen) from the drill rig.
- Overhead utility wires, i.e., electrical and telephone, can be hazardous when the drill rig boom is in the upright position.
- Underground pipelines and utility lines can be ruptured or damaged during active drilling operations.

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- To minimize exposure to chemical contaminants, a thorough review of suspected contaminants should be completed and an adequate protection program should be implemented.
- Proper lifting (pre-lift weight assessment, use of legs, multiple personnel) techniques will prevent back strain. Use slow, easy motions when shoveling, auguring, and digging to decrease muscle strain.
- Material Safety Data Sheets for all decontamination solutions should be included with each Site Health and Safety Plan.
- First aid equipment should be available based on MSDS requirements.

4.3.5 Soil Borings

Chemical Hazards	Protective Clothing		Air Monitoring/Sampling Required
29. Lead 30. Cadmium 31. Phenol 32. Arsenic 33. Zinc 34. Barium 35. Toluene	Level of Protection "C" if site activities warrant LEVEL D APPLIES TO NON-FILL AREAS e.g. SITE PERIMETER, MUDFLAT, WHICH ARE NOT CONTAM. M 5/23/00		
Physical Hazards	Cartridge Type	Outer Glove	Particulate VOC Personal Air Sampler
37. Slip/Trip/Fall 38. Work Near Water 39. Insects 40. Animals 41. Trenches 42. Confined Space 43. Heavy Equipment 44. Noise 45. Poisonous Plants	GME-P100	Nitrile	
	Type of Suit Tyvek	Foot Cover Latex	
	Inner Glove Nitrile Surgical	Special Requirements PFD	

Hazards generally associated with drilling operations include the following:

- Noise levels exceeding the OSHA PEL of 90 dBA are both a hazard and a hindrance to communication.
- Fumes (carbon monoxide and/or oxides of nitrogen) from the drill rig.
- Overhead utility wires, i.e., electrical and telephone, can be hazardous when the drill rig boom is in the upright position.
- Underground pipelines and utility lines can be ruptured or damaged during active drilling operations.

- Clothing may get caught in moving parts on the drill rig, i.e. augers.
- Free or falling parts from the excavator bucket may cause head injury.
- Moving the drill rig over uneven terrain may cause the vehicle to roll over or get stuck in a rut or mud. Be aware of hazards associated with moving heavy machinery and other associated injury.
- High-pressure hydraulic lines and airlines used on drill rigs are hazardous when they are in ill repair or incorrectly assembled.

HAZARD PREVENTION

Prevent on-site accidents and illnesses by exercising the following precautions:

- Review the contaminants suspected to be on site and perform air monitoring as required. Shut down drill rig and/or divert exhaust fumes.
- Inspect all chains, lines, cables should be inspected daily for weak spots, frays, etc.
- Wear ears muffs and/or earplugs to reduce noise levels.
- Wear hard hats at all times when working around a drill rig. Secure loose clothing. Check boom prior to approaching drill rig.
- Lower the drill rig boom prior to moving the rig. Overhead utilities should be considered "live" until determined otherwise.
- Do not erect the rig mast within 10 feet of an overhead electrical line until the line is de-energized, grounded, or shielded and an electrician has certified that arcing cannot occur.
- Conduct a thorough underground utility search before the commencement of a drilling project.
- Check or inspect all high-pressure lines prior to and during use.
- Minimum working distances around "live" overhead power lines are:

Minimum Safe Distances	
Minimum working voltage (kilovolt) range (phase to phase)	Clear Hot Stick Distance
2.1 to 15	2.0 ft. 0 in.
15 to 35	2.0 ft. 4 in.
35.1 to 46	2.0 ft. 6 in.
46.1 to 72.5	3 ft. 0 in.
72.6 to 121	3 ft. 0 in.

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138 to 145	3 ft. 6 in.
161 to 169	3 ft. 8 in.
230 to 242	5.0 ft 0 in.
345 to 362	7 ft. 0 in.
500 to 552	11 ft. 0 in.
700 to 765	15 ft. 0 in.

4.3.6 Surface Water Sampling

Chemical Hazards	Protective Clothing		Air Monitoring/Sampling Required
None expected in SW	Level of Protection "D" upgrade to Level "C" if conditions warrant		
Physical Hazards 1. Slip/Trip/Fall 2. Work Near Water 3. Insects 4. Animals 5. Noise 6. Poisonous Plants	Cartridge Type GME-P100 Type of Suit Tyvek Inner Glove Nitrile Surgical	Outer Glove Nitrile Foot Cover Leather Work Boot Special Requirements PFD	Particulate Personal Air Sampler

Both physical and chemical hazards are associated with water sampling, and they include the following:

- Contact with contaminated water; and
- Drowning due to slipping, tripping, or falling while sampling (including by falling out of a boat). The use of personal protective clothing can increase the likelihood of drowning and accidents, due to the added weight and cumbersome nature of PPE.

HAZARD PREVENTION

Prevent on-site accidents and illnesses by exercising the following precautions:

- Sampling should be done on the bank of the stream or river and the sampler should be secured with a safety line. The sampler should wear chemical resistant hip waders, and not stand in water deeper than his/her knee.
- If a boat must be used, a rowboat with floating oars should be employed. Two samplers should be in the boat, seated on opposite ends, and each should wear a life preserver. Samplers should remain seated while in the boat, and if feasible, the boat should be connected to the shore by a rope. A safety watch should be positioned on shore.

- The buddy system should be used at all times.

4.3.9 Sediment Sampling

Chemical Hazards	Protective Clothing		Air Monitoring/Sampling Required
1. Lead (primary hazard)	Level of Protection "D" upgrade to Level "C" if site conditions warrant		
Physical Hazards	Cartridge Type	Outer Glove	
1. Slip/Trip/Fall	GME-P100	Nitrile	Particulate
2. Work Near Water			VOC
3. Insects	Type of Suit	Foot Cover	Personal Air Sampler
4. Animals	Tyvek	Leather Work Boot	
5. Trenches			
6. Confined Space	Inner Glove	Special Requirements	
7. Heavy Equipment	Nitrile Surgical	PFD	
8. Noise			
9. Poisonous Plants			

Sediment is collected from beneath an aqueous layer either directly using a hand-held device, such as a shovel, trowel, or auger, or indirectly using a remotely activated device, such as Ponar dredge. Both physical and chemical hazards are associated with sediment sampling, and they include the following:

- Contact with contaminated sediment; and,
- Drowning due to slipping, tripping, or falling while sampling (including falling out of a boat). The use of personal protective clothing can increase the likelihood of drowning and accidents, due to the added weight and cumbersome nature of PPE.

HAZARD PREVENTION

Prevent on-site accidents and illnesses by exercising the following precautions:

- Sampling should be done on the bank of the stream or river and the sampler should be secured with a safety line. The sampler should wear chemical resistant hip waders, and not stand in water deeper than his/her knee.
- If a boat must be used, a row boat with floating oars should be employed. Two samplers should be in the boat, seated on opposite ends, and each should wear a life preserver. Samplers should remain seated while in the boat, and if feasible, the boat should be connected to the shore by a rope. A safety watch should be positioned on shore.
- The buddy system should be used at all times.

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4.3.10 Drum/Container Sampling

<i>Chemical Hazards</i> 1. Lead 2. Cadmium 3. Phenol 4. Toluene 5. Arsenic 6. Zinc	<i>Protective Clothing</i> Level of Protection "B"		<i>Air Monitoring/Sampling Required</i>
<i>Physical Hazards</i> 1. Slip/Trip/Fall 2. Work Near Water 3. Insects 4. Animals 5. Trenches 6. Confined Space 7. Heavy Equipment 8. Noise 9. Poisonous Plants	<i>Cartridge Type</i> GME-P100 <i>Type of Suit</i> Tyvek under Saranex <i>Inner Glove</i> Nitrile Surgical	<i>Outer Glove</i> Nitrile <i>Foot Cover</i> Latex <i>Special Requirements</i> Silver Shield or Butyl Apron	VOC

Hazards generally associated with drum sampling include the following:

- The drums or containers to be sampled could be in various stages of deterioration.
- Personnel may come in contact with unknown wastes. Depending upon the sampling method used, waste may be splashed onto personnel, or exposed through the handling of sampling instruments used to extract waste.

HAZARD PREVENTION

Prevent on-site accidents and illnesses by exercising the following precautions:

- Prior to any sampling, a sampling plan should be developed. The plan should include background information on the waste, a determination of which drums should be sampled and selection of the appropriate sampling devices and containers. Health and Safety personnel should determine the appropriate personal protective equipment to be used during sampling, decontamination, and packaging of the samples.
- Visually inspect all drums and containers for physical condition such as rusting, swelling, and risk of structural failure; symbols or other markings that may indicate the contents, such as DOT labels and manufacturer's labels; note drum type, such as stainless steel, plastic, or metal; and note configuration of drum head, such as open headed or bung.

When manually sampling a drum, use the following techniques:

ORIGINAL

- Keep sampling personnel at a safe distance while drums are being opened. Samples only after opening operations are complete.
- Do not lean over other drums to reach the drum being sampled, unless absolutely necessary.
- Cover drum tops with plastic sheeting or other suitable non-contaminated materials to avoid excessive contact with the drum tops.
- Never stand on drums; use mobile steps or another platform to achieve the height necessary to safely sample the drums.
- Obtain samples with either glass rods or vacuum pumps. Do not use contaminated items when sampling, as these may contaminate the sample and may not be compatible with the waste in the drum. Glass rods should be removed prior to pumping to minimize damage to pumps.

4.3.11 Hazard Characterization

<i>Chemical Hazards</i>	<i>Protective Clothing</i>		<i>Air Monitoring/Sampling Required</i>
7. Lead 8. Cadmium 9. Phenol 10. Toluene 11. Arsenic 12. Zinc	Level of Protection "C"		
<i>Physical Hazards</i> No physical hazards are associated with this task.	<i>Cartridge Type</i> GME-P100	<i>Outer Glove</i> Nitrile	VOC
	<i>Type of Suit</i> Tyvek under Saranex	<i>Foot Cover</i> Leather Work Boot	
	<i>Inner Glove</i> Nitrile Surgical	<i>Special Requirements</i>	

Hazards generally encountered during compatibility testing include the following:

- Eye and face hazards due to splashing.
- Skin hazard due to spills.
- Substances can be bumped out of the tube as a result of improper heating.
- Improper mixing such as adding water or reagent to an unknown material.

ORIGINAL

HAZARD PREVENTION

- If possible, utilize a laboratory facility or establish a temporary laboratory area on-site.
- Wear safety glasses or face shield to protect from splattering or extreme water reactive materials.

4.3.12 Tank Sampling

Chemical Hazards	Protective Clothing		Air Monitoring/Sampling Required
1. Lead 2. Cadmium 3. Phenol 4. Toluene 5. Zinc 6. Arsenic 7. Chromium	Level of Protection "B"		
Physical Hazards	Cartridge Type	Outer Glove	VOC
1. Slip/Trip/Fall 2. Work Near Water 3. Confined Space 4. Heavy Equipment 5. Noise	N/A	Nitrile	
	Type of Suit Tyvek under Saranex	Foot Cover Leather Work Boot	
	Inner Glove Nitrile Surgical	Special Requirements PFD	

Hazards associated with the sampling of under-ground tanks include the following:

- Contents of the tanks may be under pressure, water reactive, flammable, air reactive, etc. The chemical/physical properties of a substance may be unknown.
- Noxious gases may be released when sludges are disturbed.
- Improper lifting of sampling equipment or opening of sampling ports may cause back strain.

Hazards associated with the sampling of aboveground tanks include:

- The use of scaffolding or ladders.
- A significant risk exists when opening a tank whose contents are under pressure, or reactive to air. Flammable substances can be ignited by the spark created from a wrench or other tool used to open the port. Sparks from a welding tool used to cut tanks can also ignite flammable substances.

ORIGINAL

- Oxygen levels may be inadequate, non-existent, or displaced, in which case a confined space entry procedure is required.
- If a remote opening and/or sampling is conducted, the machinery must meet the specific OSHA requirements such as inspection logs and back-up alarms.

Hazards associated with the sampling of under-ground tanks include the following:

- Contents of the tanks may be under pressure, water reactive, flammable, air reactive, etc. The chemical/physical properties of a substance may be unknown.
- Noxious gases may be released when sludge is disturbed.
- Improper lifting of sampling equipment or opening of sampling ports may cause back strain.

Hazards associated with the sampling of aboveground tanks include:

- The use of scaffolding or ladders.
 - A significant risk exists when opening a tank whose contents are under pressure, or reactive to air. Flammable substances can be ignited by the spark created from a wrench or other tool used to open the port. Sparks from a welding tool used to cut tanks can also ignite flammable substances.
 - Oxygen levels may be inadequate, non-existent, or displaced; in which case a confined space entry procedure is required.
 - If a remote opening and/or sampling is conducted, the machinery must meet the specific OSHA requirements such as inspection logs and back-up alarms.
- ✓ Maintenance records on the vehicle should be maintained while on site.
- ✓ All scaffolds used on site must conform to OSHA Regulations 29 CFR 1910.28 and ladders must conform with OSHA Regulations 29 CFR 1910.25 and .26.

4.4 Geophysical Monitoring

4.4.1 Ground Penetrating Radar

<i>Chemical Hazards</i> 1. Lead 2. Cadmium 3. Phenol 4. Zinc 5. Arsenic 6. Toluene	<i>Protective Clothing</i> Level of Protection "D" upgrade to Level "C" if site conditions warrant		<i>Air Monitoring/Sampling</i> <i>Required</i>
<i>Physical Hazards</i> 1. Slip/Trip/Fall 2. Work Near Water 3. Insects 4. Animals 5. Heavy Equipment 6. Noise 7. Poisonous Plants	<i>Cartridge Type</i> GME-P100 <i>Type of Suit</i> Tyvek <i>Inner Glove</i> Nitrile Surgical	<i>Outer Glove</i> Nitrile <i>Foot Cover</i> Leather Work Boot <i>Special Requirements</i> PFD	Particulate

Ground Penetrating Radar (GPR) and other geophysical survey techniques are used to determine subsurface conditions without intrusive contact activities. General hazards associated with GPR activities are:

- The GPR instrument operates on a car battery, which contains corrosive acids.
- Due to the GPR's weight and awkwardness, moving the instrument over rough terrain can cause muscle and back strain hazards.

HAZARD PREVENTION

General hazard prevention can be found in the Site Surveying Hazard identification task.

- Implementation of proper maintenance procedures and use of protective gloves should adequately protect personnel from corrosive battery acid. Proper use and maintenance of the battery will not pose a hazard to the user under normal conditions.
- The battery should only be charged in a clean, dry area.
- Periodically clean the electrodes with a mild, basic solution, such as baking soda and water.

- To decrease the potential of muscle and back strain when using the GPR, lift with the legs, using slow, methodical movements.
- First aid and eyewash should be available in work area.

4.5 Removal Activities

4.5.1 Drum/Container Overpacking

Chemical Hazards	Protective Clothing		Air Monitoring/Sampling Required
1. Lead 2. Cadmium 3. Phenol 4. Toluene 5. Zinc 6. Arsenic	Level of Protection "C" upgrade to Level "B" if site conditions warrant		
Physical Hazards	Cartridge Type	Outer Glove	VOC
1. Slip/Trip/Fall 2. Work Near Water 3. Insects 4. Animals 5. Heavy Equipment 6. Noise 7. Poisonous Plants	GME-P100	Nitrile	
	Type of Suit Tyvek under Saranex Inner Glove Nitrile Surgical	Foot Cover Leather Work Boot Special Requirements Silver Shield or Butyl Apron	

Hazards generally associated with drum handling include the following:

- Explosion of pressurized drums (identified by swollen caps) when moved;
- Leakage or disintegration of corroded drums, causing the contents to spill; personnel may be exposed to drummed waste from handling; and,
- Back strain, falling drums and heavy machinery hazards are all associated with moving drums depending upon the method used for the drum removal, i.e., drum cart, grappler on a backhoe front-end loader, rough terrain forklift, or roller conveyor.

HAZARD PREVENTION

Prevent on-site accidents and illnesses by exercising the following precautions:

- If a drum is suspected to contain explosive or shock-sensitive waste, or is a bulging drum under pressure, special assistance might be required before handling.

SOIL PPE PLAN

- ① initiate Level "C" w/ Personnel & ambient monitoring in work zone
- ② Analyze for lead & total particulate
- ③ Implement engineering controls as needed
- ④ Decide to adjust PPE, if levels &/or engineering controls justify, to D

ORIGINAL

- Use a grappler unit constructed for explosive containment for initial handling of these drums.
- Palletize and secure drums prior to transport.
- Maintain continuous communication during handling and have siren signals for the commencement and completion of explosive waste handling activities.
- Ensure all unnecessary personnel are kept at a safe distance from all activities. Use shock resistant shields as necessary.
- Personnel should wear all appropriate personal protective equipment.
- Vehicles used should have a clear view of the roadway when carrying drums. Where necessary, have ground workers available to guide the operator motion.
- Staging areas should be provided with adequate access and egress routes.
- Leaking drums should be properly containerized before moving. In areas where spills may occur, a containment berm adequate to contain the entire volume in drums should be constructed.

4.5.2 Soil/Sediment Excavation/Grading

<i>Chemical Hazards</i>	<i>Protective Clothing</i>		<i>Air Monitoring/Sampling Required</i>
<ol style="list-style-type: none"> 1. Lead 2. Cadmium 3. Zinc 4. Arsenic 5. Phenol 	Level of Protection "C" @ 0.03 mg/m³ total dust upgrade to Level "B" if Levels of lead exceed 100 mg/m³ [29 CFR 1910.1025 (f)(3)(i)]		
<i>Physical Hazards</i>	<i>Cartridge Type</i>	<i>Outer Glove</i>	Particulate VOC
<ol style="list-style-type: none"> 1. Slip/Trip/Fall 2. Work Near Water 3. Insects 4. Animals 5. Trenches 6. Confined Space 7. Heavy Equipment 8. Noise 9. Poisonous Plants 	GME-P100	Nitrile	
	<i>Type of Suit</i> Tyvek	<i>Foot Cover</i> Leather Work Boot	
	<i>Inner Glove</i> Nitrile Surgical	<i>Special Requirements</i> PFD	

Hazards encountered during soil and test pit excavation include both chemical and physical agents, and are as follows:

ORIGINAL

- Exposure to airborne contaminants and flammable atmospheres released during intrusive activities.
- Sides of excavation can cave in. Possible burying or crushing of workers due to:
 - absence of shoring;
 - misjudgment of stability;
 - defective shoring; and,
 - undercut sides.
- Falling during ingress/egress, while monitoring, dismounting equipment, and stumbling into excavation.
- An overhead hazard can result from material, tools, rock, and/or soil falling into the excavation.
- Congested work area due to too many workers in a small area.

HAZARD PREVENTION

Soil/PPE Plan

1. Level "C" will be donned when levels of total dust exceed 0.03 mg/m^3 as measured with the personal data ram or RAM. This figure is based on the highest concentration of lead measured at 264,000 mg/kg as found in subsurface soils. A correlation between actual air sampling results and real-time instruments should be established.
 2. Air sampling parameters should include lead and total particulate.
 3. Engineering controls should be implemented and maintained.
 4. Level "D" may be worn if levels of contaminants are proven to be below the action level of $30 \text{ } \mu\text{g/m}^3$.
- No person may enter a trench or work at the foot of the face of an excavation until the Site Health and Safety Officer has inspected and determined whether Sloping or shoring is required to protect against cave-in or subsidence and the appropriate protection has been installed.
 - A competent person should provide adequate shoring or sloping of sides of the excavation.
 - Monitor for airborne contaminants. Allow test pits to purge and/or use personal protective equipment.
 - Trench and excavation must be inspected regularly by competent persons to ensure that changes in temperature, precipitation, shallow groundwater, over burden or nearby building weight, vibration or nearby equipment operation have not caused weakening of sides, faces and floors, and that protection is being maintained.

ORIGINAL

- Exposure to airborne contaminants and flammable atmospheres released during intrusive activities.
- Sides of excavation can cave in. Possible burying or crushing of workers due to:
 - absence of shoring;
 - misjudgment of stability;
 - defective shoring; and,
 - undercut sides.
- Falling during ingress/egress, while monitoring, dismounting equipment, and stumbling into excavation.
- An overhead hazard can result from material, tools, rock, and/or soil falling into the excavation.
- Congested work area due to too many workers in a small area.

HAZARD PREVENTION

- No person may enter a trench or work at the foot of the face of an excavation until the Site Health and Safety Officer has inspected and determined whether Sloping or shoring is required to protect against cave-in or subsidence and the appropriate protection has been installed.
- A competent person should provide adequate shoring or sloping of sides of the excavation.
- Monitor for airborne contaminants. Allow test pits to purge and/or use personal protective equipment.
- Trench and excavation must be inspected regularly by competent persons to ensure that changes in temperature, precipitation, shallow groundwater, over burden or nearby building weight, vibration or nearby equipment operation have not caused weakening of sides, faces and floors, and that protection is being maintained.
- Assessment of trench or excavation must be made, regardless of whether or not personnel will be working within, when heavy equipment must work nearby, prior to and during use, to ensure the trench or excavation will support the weight of the equipment without subsiding and possibly causing the equipment to tip.

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Maximum Allowable Slopes [†]

Soil or Rock Type	Maximum Allowable Slope (H:V) ¹ for Excavations less than 20 feet deep ³
Stable Rock	Vertical (90°)
Type A ²	3/4 : 1 (53°)
Type B	1 : 1 (45°)
Type C	1½ : 1 (34°)

[†] Table excerpted from 29 CFR 1926 Subpart P, Appendix B (Excavations)

1. Numbers in parentheses next to maximum allowable slopes are angles expressed in degrees from horizontal. Angles have been rounded off.
 2. A short-term maximum allowable slope of 1/2 H:V is allowed in excavations in Type A soil that are 12 feet (3.67 meters) or less in depth. Short-term maximum allowable slopes for excavations greater than twelve feet (3.67 meters) shall be ¾ H:1 V (53°).
 3. A registered professional engineer shall design sloping or benching for excavations greater than twenty feet (6.09 meters) in depth.
- Sufficient ramps or ladders must be provided to trenches or excavations to allow quick egress. Ladders may be placed no more than 25 feet apart, must be secured from shifting, and must extend at least three feet above the landing point. Use, construction, and maintenance of ladders must conform to ladder safety requirements.
 - Material removed from a trench or excavation must be placed far enough from the edge (at least 2 feet) to prevent its sliding into the excavation and/or from stressing the trench or excavation walls.
 - Access to trenching areas must be controlled and limited to those persons who are authorized. Prior to entering a trench or excavation, workers must notify the site supervisor, site health and safety officer, and nearby equipment operators whose activities could affect the trench or excavation.
 - To prevent overexertion, limit manual lifting and emphasize mechanical means where practical.
 - Maintain ample work room between workers.
 - The Backhoe is to be operated by a competent person (one with training and experience) with knowledge of safety precautions.

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- The operator should not leave his/her position until the excavation event is completed and all individuals are in a safe area. Any load is not to be left suspended.
- Load should not be taken over persons nor should anyone walk under the load.
- The Operator is responsible for assuring that the load is within the capacity of lifting.
- The Operator will avoid sudden movements with the backhoe, assure that the machine is stable, and while hoisted, limit the movement of backhoe as much as possible.
- Pre-arranged hand signals are to be made and reviewed with the backhoe operator.
- The backhoe is not to be operated within 10 feet of power lines or electrical equipment.
- Pre-arranged safety precautions should be implemented if the weather changes.
- If trench or excavation is near walkways or roadways, guards or warning barriers must be placed to alert pedestrians and drivers of the presence of the trench or excavation.
- If possible, trenches or excavations should be covered or filled in when unattended; otherwise, strong barriers must be placed around the trench or excavation, and lighting must be provided at night if the trench or excavation is near walkways or roadways.

4.5.3 Remove/Treat Sediment

<i>Chemical Hazards</i>	<i>Protective Clothing</i>		<i>Air Monitoring/Sampling Required</i>
1. Lead	Level of Protection "D" upgrade to Level "C" if site conditions warrant		
<i>Physical Hazards</i>	<i>Cartridge Type</i>	<i>Outer Glove</i>	Particulate
2. Slip/Trip/Fall	GME-P100	Nitrile	
3. Work Near Water			
4. Insects	<i>Type of Suit</i>	<i>Foot Cover</i>	
5. Animals	Tyvek	Leather Work Boot	
6. Heavy Equipment			
7. Noise	<i>Inner Glove</i>	<i>Special Requirements</i>	
8. Poisonous Plants	Nitrile Surgical	PFD	

Sediment is removed either directly using a hand-held device, such as a shovel, or trowel, or indirectly using a remotely activated device. Both physical and chemical hazards are associated with removal of sediment, and they include the following:

- Contact with or inhalation of contaminants, potentially in high concentrations in sediment;

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- Back strain and muscle fatigue due to lifting, shoveling and digging;
- Slipping, tripping, or falling while removing sediment.

HAZARD PREVENTION

To minimize exposure to chemical contaminants, a thorough review of suspected contaminants should be completed and an adequate protection program should be implemented.

- Proper lifting (pre-lift weight assessment, use of legs, multiple personnel) techniques will prevent back strain. Use slow, easy motions when shoveling, and digging to decrease muscle strain;
- The buddy system should be used at all times.

4.5.4 Restoration

Restoration is done either directly using a hand-held device, such as a shovel, or trowel, or indirectly using a remotely activated device. Both physical and chemical hazards are associated with restoration, and they include the following:

- Contact with or inhalation of respirable particulates.
- Back strain and muscle fatigue due to lifting.
- Slipping, tripping, or falling.

HAZARD PREVENTION

- To minimize exposure to respirable particulates an adequate protection program should be implemented.
- Proper lifting (pre-lift weight assessment, use of legs, multiple personnel) techniques will prevent back strain.
- The buddy system should be used at all times.

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4.6 NIOSH Chemical Hazard Tables

<http://www.cdc.gov/niosh/npg/npgd0000.html>

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NIOSH Pocket Guide to Chemical Hazards

Chromium metal		CAS 7440-47-3	
Cr		RTECS GB4200000	
Synonyms & Trade Names Chrome, Chromium		DOT ID & Guide	
Exposure Limits	NIOSH REL: TWA 0.5 mg/m ³ See Appendix C		
	OSHA PEL*: TWA 1 mg/m ³ See Appendix C [*Note: The PEL also applies to insoluble chromium salts.]		
IDLH 250 mg/m ³ (as Cr) See: 7440473		Conversion	
Physical Description Blue-white to steel-gray, lustrous, brittle, hard, odorless solid.			
MW: 52.0	BP: 4788°F	MLT: 3452°F	Sol: Insoluble
VP: 0 mmHg (approx)	IP: NA		Sp.Gr: 7.14
Fl.P: NA	UEL: NA	LEL: NA	
Noncombustible Solid in bulk form, but finely divided dust burns rapidly if heated in a flame.			
Incompatibilities & Reactivities Strong oxidizers (such as hydrogen peroxide), alkalis			
Measurement Method Filter; Acid; Flame atomic absorption spectrometry, IV [#7024] See: NMAM INDEX			
Personal Protection & Sanitation Skin: N.R. Eyes: N.R. Wash skin: N.R. Remove: N.R. Change: N.R.		First Aid (See procedures) Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately	
Respirator Recommendations NIOSH Up to 2.5 mg/m ³ : (APF = 5) Any dust and mist respirator* Up to 5 mg/m ³ : (APF = 10) Any dust and mist respirator except single-use and quarter-mask respirators*/(APF = 10) Any supplied-air respirator* Up to 12.5 mg/m ³ : (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*/(APF = 25) Any powered, air-purifying respirator with a dust and mist filter* Up to 25 mg/m ³ : (APF = 50) Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter/(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*/(APF = 50) Any self-contained breathing apparatus with a full facepiece/(APF = 50) Any supplied-air respirator with a full facepiece Up to 250 mg/m ³ : (APF = 2000) Any supplied-air respirator that has a full facepiece and is			

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operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000)

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape: (APF = 50) Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin; lung fibrosis (histologic)

Target Organs Eyes, skin, respiratory system

See also: INTRODUCTION See ICSC CARD: 0029 See MEDICAL TESTS: 0052

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Copper (dusts and mists, as Cu)		CAS 7440-50-8	
Cu		RTECS GL5325000	
Synonyms & Trade Names Copper metal dusts, Copper metal fumes		DOT ID & Guide	
Exposure Limits	NIOSH REL*: TWA 1 mg/m ³ [*Note: The REL also applies to other copper compounds (as Cu) except Copper fume.]		
	OSHA PEL*: TWA 1 mg/m ³ [*Note: The PEL also applies to other copper compounds (as Cu) except copper fume.]		
IDLH 100 mg/m ³ (as Cu) See: 7440508		Conversion	
Physical Description Reddish, lustrous, malleable, odorless solid.			
MW: 63.5	BP: 4703°F	MLT: 1981°F	Sol: Insoluble
VP: 0 mmHg (approx)	IP: NA		Sp.Gr: 8.94
FLP: NA	UEL: NA	LEL: NA	
Noncombustible Solid in bulk form, but powdered form may ignite.			
Incompatibilities & Reactivities Oxidizers, alkalis, sodium azide, acetylene			
Measurement Method Filter; Acid; Flame atomic absorption spectrometry; IV [#7029] See: <u>NMAM INDEX</u>			
Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet or contaminated Change: Daily		First Aid (See procedures) Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately	
Respirator Recommendations NIOSH/OSHA Up to 5 mg/m ³ : (APF = 5) Any dust and mist respirator* Up to 10 mg/m ³ : (APF = 10) Any dust and mist respirator except single-use and quarter-mask respirators*/(APF = 10) Any supplied-air respirator* Up to 25 mg/m ³ : (APF = 25) Any supplied-air respirator operated in a continuous-flow mode*/(APF = 25) Any powered, air-purifying respirator with a dust and mist filter* Up to 50 mg/m ³ : (APF = 50) Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter/(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*/(APF = 50) Any self-contained breathing apparatus with a full facepiece/(APF = 50) Any supplied-air respirator with a full facepiece			

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Up to 100 mg/m³ (APF = 2,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000)

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape: (APF = 50) Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms irritation eyes, nose, pharynx; nasal septum perforation; metallic taste; dermatitis; in animals: lung, liver, kidney damage; anemia

Target Organs Eyes, skin, respiratory system, liver, kidneys (increase(d) risk with Wilson's disease)

See also: INTRODUCTION See ICSC CARD: 0240 See MEDICAL TESTS: 0057

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NIOSH Pocket Guide to Chemical Hazards

Arsenic (inorganic compounds, as As)		CAS 7440-38-2 (metal)	
As (metal)		RTECS CG0525000 (metal)	
Synonyms & Trade Names Arsenic metal: Arsenia Other synonyms vary depending upon the specific As compound. [Note: OSHA considers "Inorganic Arsenic" to mean copper acetoarsenite & all inorganic compounds containing arsenic except ARSINE.]		DOT ID & Guide 1558 <u>152</u> (metal) 1562 <u>152</u> (dust)	
Exposure Limits	NIOSH REL: Ca C 0.002 mg/m ³ [15-minute] See Appendix A		
	OSHA PEL: [1910.1018] TWA 0.010 mg/m ³		
IDLH Ca [5 mg/m ³ (as As)] See: <u>IDLH INDEX</u>		Conversion	
Physical Description Metal: Silver-gray or tin-white, brittle, odorless solid.			
MW: 74.9	BP: Sublimes	MLT: 1135°F (Sublimes)	Sol: Insoluble
VP: 0 mmHg (approx)	IP: NA		Sp.Gr: 5.73 (metal)
FLP: NA	UEL: NA	LEL: NA	
Metal: Noncombustible Solid in bulk form, but a slight explosion hazard in the form of dust when exposed to flame.			
Incompatibilities & Reactivities Strong oxidizers, bromine azide [Note: Hydrogen gas can react with inorganic arsenic to form the highly toxic gas arsine.]			
Measurement Method Filter; Acid; Hydride generation atomic absorption spectrometry; IV [#7900] [Also #7300, Elements] See: <u>NMAM INDEX</u>			
Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated/Daily Remove: When wet or contaminated Change: Daily Provide: Eyewash, Quick drench		First Aid (See procedures) Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately	
Respirator Recommendations NIOSH At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure			

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mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted acid gas canister having a high-efficiency particulate filter/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, skin and/or eye contact ingestion

Symptoms Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin, [Potential occupational carcinogen]

Target Organs Liver, kidneys, skin, lungs, lymphatic system

Cancer Site [lung & lymphatic cancer]

See also: INTRODUCTION

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NIOSH Pocket Guide to Chemical Hazards

Lead		CAS 7439-92-1	
Pb		RTECS OF7525000	
Synonyms & Trade Names Lead metal, Plumbum		DOT ID & Guide	
Exposure Limits	NIOSH REL*: TWA 0.100 mg/m ³ See Appendix C [*Note: The REL also applies to other lead compounds (as Pb) -- see Appendix C.]		
	OSHA PEL*: [1910.1025] TWA 0.050 mg/m ³ See Appendix C [*Note: The PEL also applies to other lead compounds (as Pb) -- see Appendix C.]		
IDLH 100 mg/m ³ (as Pb) See: 7439921		Conversion	
Physical Description A heavy, ductile, soft, gray solid.			
MW: 207.2	BP: 3164°F	MLT: 621°F	Sol: Insoluble
VP: 0 mmHg (approx)	IP: NA		Sp.Gr: 11.34
Fl.P: NA	UEL: NA	LEL: NA	
Noncombustible Solid in bulk form.			
Incompatibilities & Reactivities Strong oxidizers, hydrogen peroxide, acids			
Measurement Method Filter; HNO ₃ /H ₂ O ₂ ; Flame atomic absorption spectrometry; IV [#7082] [Also #7105, #7300, #7700, #7701, #7702] See: NMAM INDEX			
Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: Daily Remove: When wet or contaminated Change: Daily		First Aid (See procedures) Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately	
Respirator Recommendations OSHA Up to 0.5 mg/m ³ : (APF = 10) Any air-purifying respirator with a high-efficiency particulate filter/ (APF = 10) Any supplied-air respirator Up to 1.25 mg/m ³ : (APF = 25) Any supplied-air respirator operated in a continuous-flow mode/ (APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter Up to 2.5 mg/m ³ : (APF = 50) Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter/(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode/(APF = 50) Any powered, air-purifying respirator with a tight-			

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any self-contained breathing apparatus with a full facepiece/(APF = 50) Any supplied-air respirator with a full facepiece

Up to 50 mg/m³: (APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Up to 100 mg/m³: (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000)

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape: (APF = 50) Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms weakness, lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypotension

Target Organs Eyes, gastrointestinal tract, central nervous system, kidneys, blood, gingival tissue

See also: INTRODUCTION See ICSC CARD: 0052 See MEDICAL TESTS: 0127

NIOSH Pocket Guide to Chemical Hazards

Particulates not otherwise regulated		CAS	
		RTECS	
Synonyms & Trade Names "Inert" dusts, Nuisance dusts, PNOR [Note: Includes all inert or nuisance dusts, whether mineral, inorganic, not listed specifically in 1910.1000.]		DOT ID & Guide	
Exposure Limits	NIOSH REL: <u>See Appendix D</u>		
	OSHA PEL: TWA 15 mg/m ³ (total) TWA 5 mg/m ³ (resp)		
IDLH N.D. See: <u>IDLH INDEX</u>		Conversion	
Physical Description Dusts from solid substances without specific occupational exposure standards.			
Properties vary depending upon the specific solid.			
Incompatibilities & Reactivities Varies			
Measurement Method Filter; none; Gravimetric; IV [Particulates NOR: #0500 (total), #0600 (respirable)] See: <u>NMAM INDEX</u>			
Personal Protection & Sanitation Skin: N.R. Eyes: N.R. Wash skin: N.R. Remove: N.R. Change: N.R.		First Aid (See procedures) Eye: Irrigate immediately Breathing: Fresh air	

Respirator Recommendations To be added later
Exposure Routes inhalation, skin and/or eye contact
Symptoms irritation eyes, skin, throat, upper respiratory system
Target Organs Eyes, skin, respiratory system
See also: <u>INTRODUCTION</u>

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NIOSH Pocket Guide to Chemical Hazards

Phenol		CAS 108-95-2	
C₆H₅OH		RTECS SJ3325000	
Synonyms & Trade Names Carbolic acid, Hydroxybenzene, Monohydroxybenzene, Phenyl alcohol, Phenyl hydroxide		DOT ID & Guide 1671 <u>153</u> (solid) 2312 <u>153</u> (molten) 2821 <u>153</u> (solution)	
Exposure Limits	NIOSH REL: TWA 5 ppm (19 mg/m ³) C 15.6 ppm (60 mg/m ³) [15-minute] [skin]		
	OSHA PEL: TWA 5 ppm (19 mg/m ³) [skin]		
IDLH 250 ppm See: <u>108952</u>		Conversion 1 ppm = 3.85 mg/m ³	
Physical Description Colorless to light-pink, crystalline solid with a sweet, acrid odor. [Note: Phenol liquefies by mixing with about 8% water.]			
MW: 94.1	BP: 359°F	MLT: 109°F	Sol(77°F): 9%
VP: 0.4 mmHg	IP: 8.50 eV		Sp.Gr: 1.06
FLP: 175°F	UEL: 8.6%	LEL: 1.8%	
Combustible Solid			
Incompatibilities & Reactivities Strong oxidizers, calcium hypochlorite, aluminum chloride, acids			
Measurement Method XAD-7® (tube); Methanol; Gas chromatography/Flame ionization detection; IV [<u>#2546</u> , Cresols and Phenol] See: <u>NMAM INDEX</u>			
Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet or contaminated Change: Daily Provide: Eyewash, Quick drench		First Aid (See procedures) Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately	
Respirator Recommendations NIOSH/OSHA Up to 50 ppm: (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s) in combination with a dust and mist filter/(APF = 10) Any supplied-air respirator Up to 125 ppm: (APF = 25) Any supplied-air respirator operated in a continuous-flow mode/(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s) in combination with a dust and mist filter Up to 250 ppm: (APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter/(APF = 50) Any air-			

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purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having a high-efficiency particulate filter/(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter/(APF = 50) Any self-contained breathing apparatus with a full facepiece/(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000)

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having a high-efficiency particulate filter/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, nose, throat; anorexia, weight loss; weakness, muscle ache, pain; dark urine; cyanosis; liver, kidney damage; skin burns; dermatitis; ochronosis; tremor, convulsions, twitching

Target Organs Eyes, skin, respiratory system, liver, kidneys

See also: INTRODUCTION See ICSC CARD: 0070 See MEDICAL TESTS: 0182

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Toluene		CAS 108-88-3	
C₆H₅CH₃		RTECS XS5250000	
Synonyms & Trade Names Methyl benzene, Methyl benzol, Phenyl methane, Toluol		DOT ID & Guide 1294 130	
Exposure Limits	NIOSH REL: TWA 100 ppm (375 mg/m ³) ST 150 ppm (560 mg/m ³)		
	OSHA PEL†: TWA 200 ppm C 300 ppm 500 ppm (10-minute maximum peak)		
IDLH 500 ppm See: 108883		Conversion 1 ppm = 3.77 mg/m ³	
Physical Description Colorless liquid with a sweet, pungent, benzene-like odor.			
MW: 92.1	BP: 232°F	FRZ: -139°F	Sol(74°F): 0.07%
VP: 21 mmHg	IP: 8.82 eV		Sp.Gr: 0.87
Fl.P: 40°F	UEL: 7.1%	LEL: 1.1%	
Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.			
Incompatibilities & Reactivities Strong oxidizers			
Measurement Method Charcoal tube; CS ₂ ; Gas chromatography/Flame ionization detection; IV [#1500, Hydrocarbons] [Also #4000, #1501] See: NMAM INDEX			
Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet (flammable) Change: N.R.		First Aid (See procedures) Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately	
Respirator Recommendations NIOSH Up to 500 ppm: (APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*/ (APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*/(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/(APF = 10) Any supplied-air respirator*/(APF = 50) Any self-contained breathing apparatus with a full facepiece Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure- demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus			

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Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, nose; fatigue, weakness, confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); nervousness, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage

Target Organs Eyes, skin, respiratory system, central nervous system, liver, kidneys

See also: INTRODUCTION See ICSC CARD: 0078 See MEDICAL TESTS: 0232

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5.0 PERSONNEL TRAINING REQUIREMENTS

All site personnel are to be trained in accordance with the 29 CFR 1910.120 regulation covering Hazardous Waste Operations and Emergency Response. At a minimum, all personnel are required to be trained to recognize the hazards on-site, the provisions of this HASP, and the responsible personnel.

5.1 Pre-Assignment and Refresher Training

Prior to arrival on site, each employer will be responsible for certifying that his/her employees meet the requirements of pre-assignment training, consistent with OSHA 29 CFR 1910.120 paragraph (e)(3). The employer should be able to provide a document certifying that each general site worker has received 40 hours of instruction off the site, and 24 hours of training for any workers who are on site only occasionally for a specific task. If an individual employee has work experience and/or training that is equivalent to that provided in the initial training, an employer may waive the 40-hour training so long as that equivalent experience is documented or certified. All personnel must also receive 8 hours of refresher training annually.

5.2 Site Supervisor Training

Consistent with OSHA 29 CFR 1910.120 paragraph (e)(8), individuals designated as site supervisors require an additional 8 hours of training.

5.3 Training and Briefing Topics

Table 1: Training and Briefing Topics

Training	Frequency
Air Monitoring (1910.120(h))	Daily
Chemical Hazards	Daily as required
Heavy Machinery	Daily
Personnel protective equipment, Sec. 5.0	Daily
Physical hazards, Table 3.2	Daily
Respiratory protection, Sec. 5.8	Daily
Symptoms of overexposure to hazards	Daily
Tools, [29 CFR 1910.242 - .247]	Periodically as required
Training requirements, Sec. 4.0;	Periodically

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Stamp

Training	Frequency
[29 CFR 1910.120(e)]	
Site Control, Sec. 8.0; [29 CFR 1910.120(d)]	Periodically
Medical surveillance requirements	Periodically

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6.0 PERSONAL PROTECTIVE EQUIPMENT

6.1 Levels of Protection

Wear protective equipment when response activities involve known or suspected atmospheric contamination vapors, gases, or particulates may be generated by site activities, or when direct contact with skin-affecting substances may occur. Full facepiece respirators protect the lungs, gastrointestinal tract, and eyes against airborne toxicants. Chemical-resistant clothing protects the skin from contact with skin-destructive and absorbable chemicals.

The specific levels of protection and necessary components for each have been divided into four categories according to the degrees of protection afforded:

Level A should be worn when:

The highest level of respiratory, skin, and eye protection is needed.

Level B should be worn when:

The highest level of respiratory protection is needed, but a lesser level of skin protection. Level B is the primary level of choice when encountering unknown environments.

Level C should be worn:

When the criteria for using air-purifying respirators are met, and a lesser level of skin protection is needed.

Level D should be worn:

Only as a work uniform and not in any area with respiratory or skin hazards. It provides minimal protection against chemical hazards.

Modifications of these levels are permitted, and routinely employed during site work activities to maximize efficiency. For example, Level C respiratory protection and Level D skin protection may be required for a given task. Likewise the type of chemical protective ensemble (i.e., material, format) will depend upon contaminants and degrees of contact.

The level of protection selected is based upon the following criteria:

- Type and measured concentration of the chemical substance in the ambient atmosphere and its toxicity.

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- Potential for exposure to substances in air, liquids, or other direct contact with material due to work being done.
- Knowledge of chemicals on site along with properties such as toxicity, route of exposure, and contaminant matrix.
- In situations where the type of chemical, concentration, and possibilities of contact are not known, the appropriate level of protection must be selected based on professional experience and judgment until the hazards can be better identified.

6.2 Level "A" Protective Equipment

- Supplied-air respirator approved by the Mine Safety and Health Administration (MSHA) and National Institute for Occupational Safety and Health (NIOSH). Respirators may be positive pressure-demand, self-contained breathing apparatus (SCBA), or positive pressure-demand, airline respirator with escape bottle for Immediately Dangerous to Life and Health (IDLH) or potential for IDLH atmosphere);
- Fully encapsulating or vapor tight chemical-resistant suit;
- Coveralls;
- Gloves (inner);
- Boots, chemical-resistant, steel toe and shank (depending on suit construction, worn over or under suit boot);
- Hard hat (under suit);
- Disposable gloves and boot covers (worn over fully encapsulating or vapor suit);
- Cooling unit; and
- 2-way radio communications (intrinsically safe).

6.3 Level "B" Protective Equipment

- Supplied-air respirator (MSHA/NIOSH approved). Respirators may be positive pressure demand, self-contained breathing apparatus (SCBA), or positive pressure-demand airline respirator (with escape bottle for IDLH or potential for IDLH atmosphere)

- Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one or two piece chemical-splash suit; disposable chemical-resistant, one-piece suits;
- Long cotton underwear;
- Coveralls;
- Gloves (outer), chemical-resistant;
- Gloves (inner), chemical-resistant;
- Boots (outer), chemical-resistant, steel toe and shank;
- Boot covers (outer), chemical-resistant (disposable);
- Hard hat (face shield); and
- Two-way radio communications (intrinsically safe).

6.4 Level "C" Protective Equipment

- Air-purifying respirator, full-face, cartridge-equipped (MSHA/NIOSH approved);
- Chemical-resistant clothing (coveralls; hooded, one-piece or two-piece chemical splash suit;
- Chemical-resistant hood and apron; disposable chemical-resistant coveralls);
- Coveralls;
- Long cotton underwear;
- Gloves (outer), chemical-resistant;
- Gloves (inner), chemical-resistant;
- Boots (outer), chemical-resistant, steel toe and shank;
- Boot covers (outer), chemical-resistant (disposable);
- Hard hat (face shield);
- Escape mask; and,

- Two-way radio communications (intrinsically safe).

6.5 Level "D" Protective Equipment

- Coveralls;
- Gloves;
- Boots/shoes, leather or chemical-resistant, steel toe and shank;
- Safety glasses; and,
- Hard hat.

6.6 Reassessment of Program

The level of protection provided by PPE selection shall be upgraded or downgraded based upon a change in site conditions or findings of investigations. When a significant change occurs, the hazards should be reassessed. Some indicators of the need for reassessment are:

- Commencement of a new work phase, such as the start of drum sampling or work that begins on a different portion of the site;
- Change in job tasks during a work phase;
- Change of season/weather;
- When temperature extremes or individual medical considerations limit the effectiveness of PPE;
- Contaminants other than those previously identified are encountered;
- Change in ambient levels of contaminants; and
- Change in work scope that affects the degree of contact with contaminants.

6.7 Work Mission Duration

The anticipated duration of the work mission should be established before the workers actually begin work in their PPE ensembles. Several factors limit mission length, including:

- Air supply consumption (SCBA use);

- Suit/Ensemble permeation and penetration rates for chemicals (See Section 5.8);
- Ambient temperature and weather conditions (heat stress, cold stress); and
- Capacity of personnel to work in PPE.

6.8 SOP for Personal Protective Equipment

6.8.1 Inspection

Proper inspection of PPE features several sequences of inspection depending upon specific articles of PPE and its frequency of use. The different levels of inspection are as follows:

- Inspection and operational testing of equipment received from the factory or distributor;
- Inspection of equipment as it is issued to workers;
- Inspection after use or training and prior to maintenance;
- Periodic inspection of stored equipment; and
- Periodic inspection when a question arises concerning the appropriateness of the selected equipment, or when problems with similar equipment arise.
- The primary inspection of PPE for activities at the Site will occur prior to immediate use and will be conducted by the user. This inspection ensures that the user is familiar with its use.

6.8.2 PPE Inspection List

Before use, inspect clothing for the following:

Determine that the clothing material is appropriate for the specified task at hand.

√ Visually inspect for:

- √ imperfect seams
- √ non-uniform coatings
- √ tears
- √ malfunctioning closures

√ Hold up to light and check for pinholes.

- √ Flex product:
 - √ observe for cracks
 - √ observe for other signs of shelf deterioration
- √ Inspect clothing for the following:
 - √ discoloration
 - √ swelling
 - √ stiffness

During the work task, inspect clothing for the following:

- √ Evidence of chemical attack such as discoloration, swelling, stiffening, and softening. Keep in mind, however, that chemical permeation can occur without any visible effects;
- √ Closure failure;
- √ Tears;
- √ Punctures; and,
- √ Seam discontinuities.

Before use, visually inspect gloves for the following:

- √ Imperfect seams
- √ Tears
- √ Non-uniform coating
- √ Pressurize glove with air; listen for pinhole leaks.

6.9 Respirator Cartridge Change-Out Schedule

Respirator cartridges must be changed out according to a pre-determined schedule when being used as protection against VOA compounds. At this site, cartridges will be changed according the documentation provided. For exposures to particulate matter, cartridges will be changed when there is a noted increase in breathing resistance.

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6.9.1 Respirator Cartridge Change-Out Documentation

Cartridges will be changed when resistance to breathing is felt. This is based on the primary site threat of lead particulate. As conditions change, this change-out will be reassessed.

<http://www.msanet.com/safetyproducts/cartlife/msa.html>

7.0 MEDICAL SURVEILLANCE REQUIREMENTS

Medical monitoring programs are designed to track the physical condition of employees on a regular basis, as well as survey pre-employment or baseline conditions prior to potential exposures. The medical surveillance program is a part of each employer's Health and Safety program.

7.1 *Baseline or Pre-Assignment Monitoring*

Prior to being assigned to a hazardous or a potentially hazardous activity involving exposure to toxic materials, an employee must receive a pre-assignment or baseline physical. The contents of the physical are to be determined by the employer's medical consultant. As suggested by NIOSH/OSHA/USCG/EPA's Occupational Safety & Health Guidance Manual for Hazardous Waste Site Activities, the minimum medical monitoring requirements for work at the Site are as follows:

- Complete medical and work histories;
- Physical examination;
- Pulmonary function tests (FVC and FEV1);
- Chest X-ray (every three years);
- EKG;
- Eye examination and visual acuity;
- Audiometry;
- Urinalysis;
- Blood chemistry; and
- Heavy metals toxicology.

The pre-assignment physical should categorize employees as fit-for-duty and able to wear respiratory protection.

7.2 *Periodic Monitoring*

In addition to a baseline physical, all employees require a periodic physical within the last 12 months unless the advising physician believes a shorter interval is appropriate. The employer's medical consultant should prescribe an adequate medical exam that fulfills OSHA 29 CFR 1910.120 requirements. The pre-assignment physical outlined above may be applicable.

All personnel working in contaminated or potentially contaminated areas at the Site will verify currency (within 12 months) with respect to medical monitoring. Indicating the date of the last physical on the safety plan agreement form does this.

7.3 *Site Specific Monitoring*

Blood Lead/ZPP monitoring is required for this site.

7.4 *Exposure/Injury/Medical Support*

As a follow-up to an injury or possible exposure above established exposure limits, all employees are entitled to and encouraged to seek medical attention and physical testing. Depending upon the type of exposure, it is critical to perform follow-up testing within 24-48 hours. It will be up to the employer's medical consultant to advise the type of test required to accurately monitor exposure effects.

7.5 *Exit Physical*

At termination of employment or reassignment to an activity or location that does not represent a risk of exposure to hazardous substances, an employee shall require an exit physical. If his/her last physical was within the last six months, the advising medical consultant has the right to determine the adequacy and necessity of an exit exam.

IMAGE __ OF __

DATE / /00

TEMPERATURE

CONDITIONS _____

[illegible]

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8.0 SITE CONTROL MEASURES

The following section defines measures and procedures for maintaining site control. Site control is an essential component in the implementation of the site health and safety program.

8.1 Buddy System

During all Level B activities or when conditions present a risk to personnel, the implementation of a buddy system is mandatory. A buddy system requires at least two people who work as a team; each looking out for each other. For example, Level B operations generally require three people. Table 8.1 lists tasks which require a buddy system and/or any additional site control requirements.

Table 2: Personnel Requirements

Tasks	Control Measures
Site Walkthrough	Buddy System
Site Survey and Sampling Grid Layout	Buddy System
Perimeter Monitoring	Line of Sight
Install Perimeter Security Fence	Line of Sight
Trailer Placement	Line of Sight
Utility Hook-up	Buddy System
Rubble Collection/Disposal	Line of Sight
Clearing/grading	Buddy System
Air Sampling/Monitoring	Line of Sight
Grid Layout	Buddy System
Surface Soil Sampling	Line of Sight
Subsurface Soil Sampling	Line of Sight
Soil Borings	Line of Sight
Surface Water Sampling	Buddy System
Sediment Sampling	Buddy System
Drum/Container Sampling	Buddy System
Hazard Characterization	Line of Sight
Tank Sampling	Buddy System
Ground Penetrating Radar	Line of Sight
Drum/Container Overpacking	Buddy System
Soil/Sediment Excavation	Buddy System
Remove/Treat Sediment	Buddy System
Home Cleaning	Line of Sight
Restoration	Line of Sight

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8.2 Site Communications Plan

Successful communications between field teams and contact with personnel in the support zone is essential. The following communications systems will be available during activities at the Site:

- Two-way radio
- Compressed air horn
- Hand signals

Hand Signals	
Signal	Definition
Hands clutching throat	Out of air/cannot breath
Hands on top of head	Need assistance
Thumbs up	OK/I am all right/I understand
Thumbs down	No/negative
Arms waving upright	Send backup support
Grip partners wrist	Exit area immediately

8.3 Nearest Medical Assistance

Figure 2 provides a map of the route to the nearest medical facility that can provide emergency care for individuals who may experience an injury or exposure on site. The route to the hospital should be verified by the HSO, and should be familiar to all site personnel.

The following individuals on site have current certification in CPR and/or first aid:

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

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8.4 Safe Work Practices

The list of standing orders for the Exclusion Zone is as follows:

- No smoking, eating, or drinking in this zone.
- No horse play.
- No matches or lighters in this zone.
- Check-in on entrance to this zone.
- Checkout on exit from this zone.
- Implement the communications system.
- Line of sight must be in position.
- Wear the appropriate level of protection as defined in the safety plan.

The list of standing orders for the Contamination Reduction Zone is as follows:

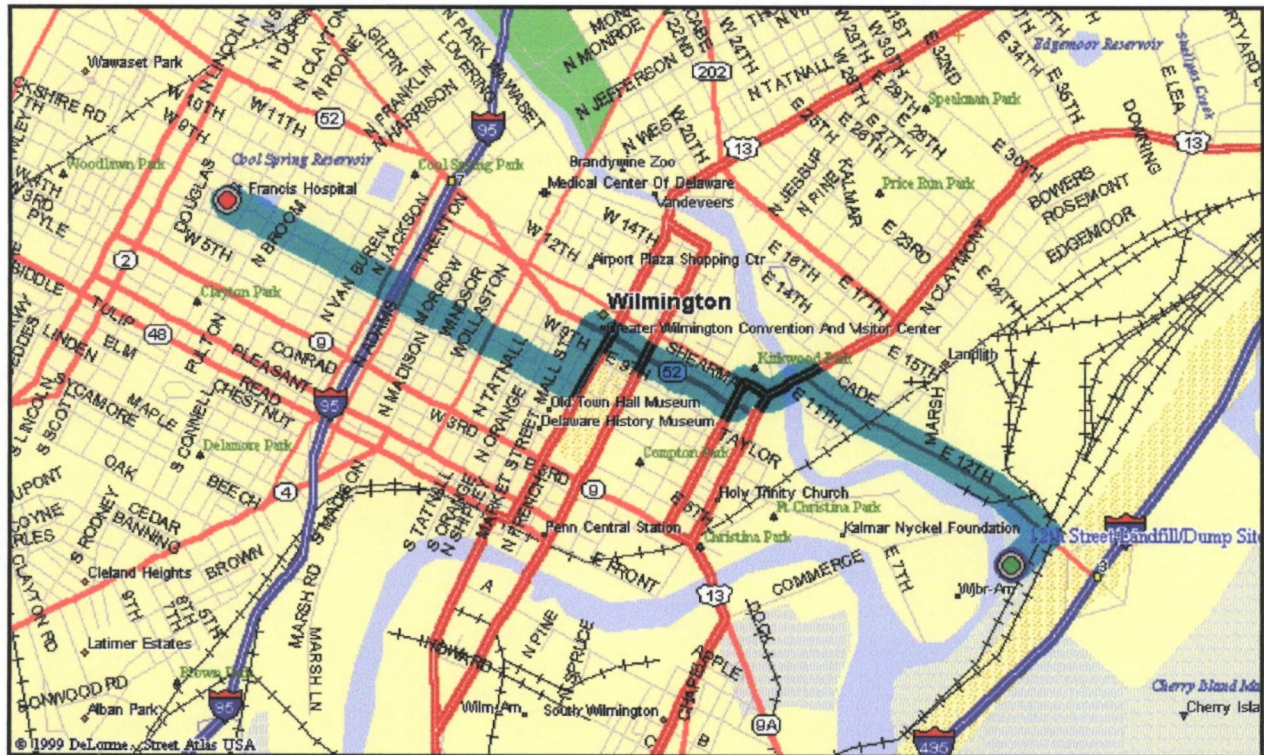
- No smoking, eating, or drinking in this zone.
- No horse play.
- No matches or lighters in this zone.
- Wear the appropriate level of protection.

8.5 Emergency Alarm Procedures

The warning signals described in section 10.4 Evacuation Routes and Procedures will be deployed in the event of an emergency. Communication signals will also be used according to Section 8.2.

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Figure 2: Map Depicting Route to Nearest Medical Facility



**Directions to St. Francis Hospital
(302) 421-4100**

Left (West) on E. 12th Street
Left (South) on Route 13
Right (West) on Route 52 (East 10th Street)
Left (South) onto Market Street
Right (West) onto 8th Street for approximately 1.2 miles – Hospital is on right

(Total Distance - 3 miles)
(Drive Time - 9 minutes)

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9.0 DECONTAMINATION PLAN

9.1 Standard Operating Procedures

Decontamination involves the orderly controlled removal of contaminants. All site personnel should minimize contact with contaminants in order to minimize the need for extensive decontamination.

The Site Safety Officer is responsible for monitoring decontamination procedures and determining their effectiveness.

9.2 Personnel Decontamination

9.2.1 Level "D" (modified) Decontamination Procedures

1. Proceed to decontamination line
2. Remove all tape
3. Remove booties
4. Remove outer gloves (if worn)
5. Remove protective suit (if worn)
6. Remove inner gloves (if worn)
7. Hand and face wash
8. Shower¹
9. Medical monitoring if necessary.

9.2.3 Level "C" Decontamination Procedures

1. Proceed to decontamination line
2. Remove all tape
3. Remove booties
4. Wash outer boots
5. Remove outer gloves
6. Remove outer suit
7. Remove outer gloves
8. Remove inner suit (if worn)
9. Remove respirator
10. Wash respirator
11. Remove inner gloves
12. Wash face and hands
13. Shower¹
14. Medical monitoring if necessary

¹ All personnel are required to shower at the end of the work shift regardless of PPE level (when exposed above the PEL) when leaving site in accordance with 29 CFR 1910.1025 (i)(3)(i). See Appendix E attached.

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9.2.3 Level "B" Decontamination Procedures

1. Proceed to decontamination line
2. Remove all tape
3. Remove booties
4. Wash outer boots
5. Remove outer gloves
6. Remove outer suit
7. Remove outer gloves
8. Remove inner suit (if worn)
9. Remove respirator
10. Wash respirator
11. Remove inner gloves
12. Wash face and hands
13. Shower¹
14. Medical monitoring if necessary

9.3 *Equipment Decontamination*

Equipment will be decontaminated before leaving the site and will vary depending on the type of equipment and nature of the contamination. Decontamination methods may include any combination of the following:

- Steam cleaning;
- Wet wiping;
- Scraping;
- Pressure washing;
- Hosing; or,
- Sweeping.

9.4 *Disposition of Decontamination Wastes*

All equipment and decontamination solutions shall be considered contaminated unless proven through testing to be not contaminated. All equipment and solvents used for decontamination shall be decontaminated or disposed of properly in accordance with appropriate state and federal regulations. Commercial laundries or cleaning establishments that decontaminate protective clothing or equipment shall be informed of the potentially harmful effects of exposures.

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10.0 EMERGENCY RESPONSE/CONTINGENCY PLAN

10.1 *Personnel Roles and Lines of Authority*

The On-Scene Coordinator has primary responsibility for responding to and correcting emergency situations. This includes taking appropriate measure to ensure the safety of site personnel and the public. Possible actions may involve evacuation of personnel from the site area, and evacuation of adjacent residents. He/she is additionally responsible for ensuring that corrective measures have been implemented, appropriate authorities notified, and follow-up reports completed. The HSO may be called upon to act on the behalf of the site supervisor, and will direct responses to any medical emergency. The individual contractor organizations are responsible for assisting the project manager in his/her mission within the parameters of their scope of work.

10.2 *Evacuation Routes/Procedures*

All personnel must be informed of the emergency evacuation procedures

In the event of an emergency that necessitates an evacuation of the site, the following alarm procedures will be implemented:

All personnel should evacuate upwind of any activities. Insure that a predetermined location is identified off-site in case of an emergency, so that all personnel can be accounted for.

Personnel will be expected to proceed to the closest exit with your buddy, and mobilize to the safe distance area associated with the evacuation route (see Figure 10.1). Personnel will remain at that area until the re-entry alarm is sounded or an authorized individual provides further instructions.

10.3 *Emergency Contact/Notification System*

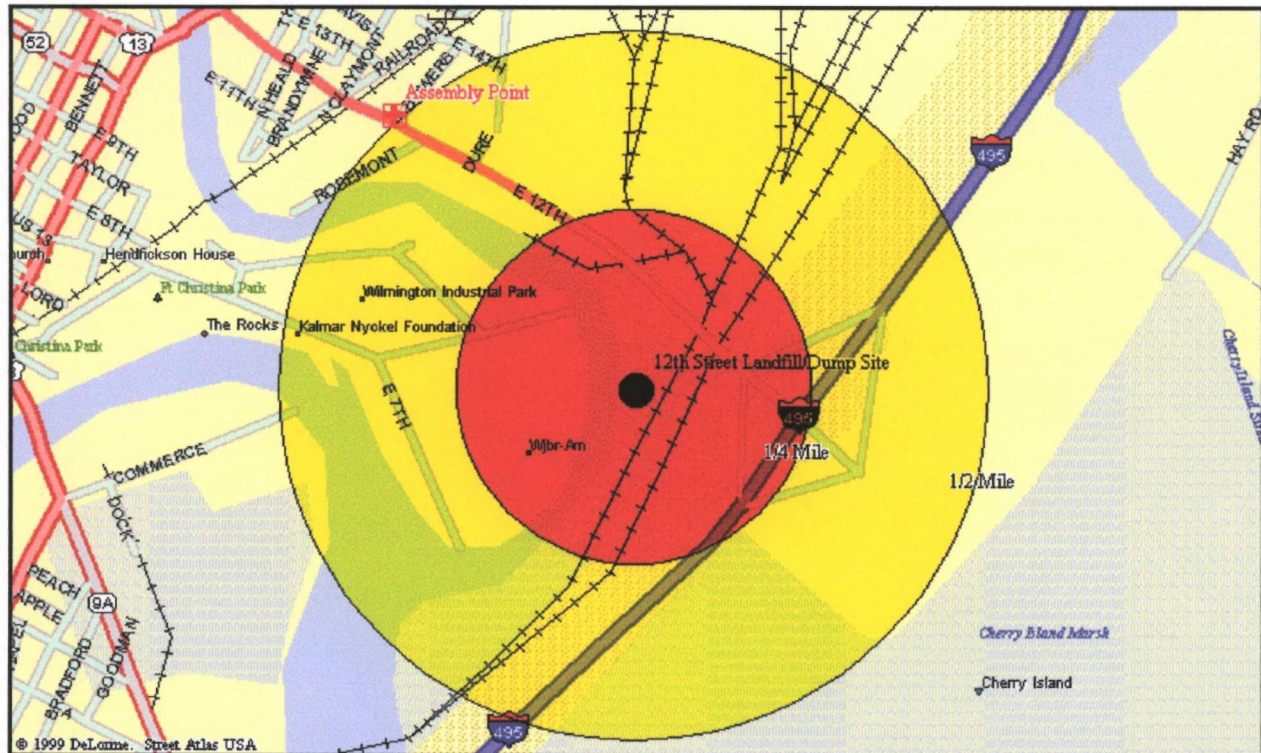
The following list provides names and telephone numbers for emergency contact personnel. In the event of a medical emergency, personnel will take direction from the HSO and notify the appropriate emergency organization. In the event of a fire or spill, the site supervisor will notify the appropriate local, state, and federal agencies.

Table 3: 12th Street Landfill/Dump Site Emergency Contact List

Name	Organization	Telephone Day Night	Pager
Police	City of Wilmington	911	
Fire	City of Wilmington	911	
Ambulance	City of Wilmington	911	
National Poison Control Center		800-942-5969	
St. Francis Hospital		302-421-4100	
Michael Towle, OSC	U.S. EPA	215-814-3272 610-696-3098	215-314-5872
12th Street Landfill/Dump, Response Manager	Guardian Environmental Services Corp.	Enter Number Here 800 345 4375	302 467 1830
Sviatlana Wilson	Roy F. Weston, Inc.	856-461-4003 610-254-0331	
Regional Response Center	U.S. EPA Region III	215-814-9016	
National Response Center	USCG	800-424-8802	
Department of Natural Resources and Environmental Control (DNREC)	Delaware	302-395-2600	
Weston Emergency Medical Consultant	Continuum	800-229-3674	
OHM Remediation Services Medical Consultant	NDC	757-466-5999 757-466-5818	
CHEMTREC (Emergency)		800-424-9300	
CHEMTREC (Non-Emergency)		800-262-8200	
ATSDR		404-639-0615	
ATF		800-424-9555	
Centers for Disease Control		404-633-5313	

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DATE: 4/10/00

Figure 3: Evacuation Routes and Safe Distances



**THE SIGNAL FOR GENERAL SITE EVACUATION WILL BE THREE
FIVE SECOND BLASTS ON A VEHICLE OR AIR HORN**

IN THE EVENT OF AN EMERGENCY REQUIRING SITE EVACUATION

All personnel will assemble at the command post for headcount

IN THE EVENT THE COMMAND POST IS UNSAFE

All personnel will assemble at intersection of Bowers and 12th Street as shown

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10.4 Emergency Medical Treatment Procedures

Any person who becomes ill or injured in the exclusion zone must be decontaminated to the maximum extent possible. If the injury or illness is minor, full decontamination should be completed and first aid administered prior to transport. If the patient's condition is serious, at least partial decontamination should be completed (i.e., complete disrobing of the victim and redressing in clean coveralls or wrapping in a blanket.) First aid should be administered while awaiting an ambulance or paramedics. All injuries and illnesses must immediately be reported to the project manager.

Any person being transported to a clinic or hospital for treatment should take with them information on the chemical(s) they have been exposed to at the site. This information is included in Section 4.6.

Any vehicle used to transport contaminated personnel will be cleaned as necessary.

10.5 Fire or Explosion

In the event of a fire or explosion, the alarm must be sounded. The local fire department should be summoned immediately. Upon their arrival, the project manager or designated alternate will advise the fire commander of the location, nature, and identification of the hazardous materials on site.

If it is safe to do so, site personnel may:

- Use fire-fighting equipment available on site to control or extinguish the fire;
- Remove or isolate flammable or other hazardous materials that may contribute to the fire;
- If the fire or explosion necessitate an evacuation of the site, the previously mentioned safety procedures should be implemented.

10.6 Spills or Leaks

In the event of a spill or a leak, site personnel will:

- Inform their supervisor immediately;
- Locate the source of the spillage and stop the flow if it can be done safely; and,
- Begin containment and recovery of the spilled materials.

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10.7 Emergency Response Equipment

The following is a list of emergency equipment and its location on site:

First Aid Kit(s)

Backboard(s)

Oxygen

Fire Extinguishers

Spill Control Kit(s)

Air Monitoring Equip.

CGI

PID

FID

RAM

_____	_____
_____	_____
_____	_____
_____	_____

Site Radios

Mobile Phones

10.7.1 Location of Additional Emergency Equipment

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11.0 CONFINED SPACE ENTRY PROCEDURES

A confined space provides the potential for unusually high concentration of contaminants, explosive atmospheres, limited visibility, and restricted movement. This section will establish requirements for safe entry into confined work in, and safe exit from confined spaces. Additional information regarding confined space entry can be found in 29 CFR 1926.21, 29 CFR 1910 and NIOSH 80-106.

11.1 Definition

Confined space: A space or work area not designed or intended for normal human occupancy, having limited means of egress and poor natural ventilation; and/or structure, including buildings or rooms, which have limited means of egress.

Confined Space Entry Permit (CSEP): A document to be initiated by the supervisor of personnel who are to enter into the work in a confined space: The Confined Space Entry Permit (CSEP) will be completed by the personnel involved in the entry and approved by the HSO before personnel will be permitted to enter the confined space. the CSEP shall be valid only for the performance of the work identified and for the location and time specified. The beginning of a new shift with change of personnel will require the issuance of a new CSEP.

Confined Space Observer: An individual assigned to monitor the activities of personnel working within a confined space. The confined space observer monitors and provides external assistance to those inside the confined space. The confined space observer summons rescue personnel in the event of emergency and assists the rescue team.

11.2 General Provisions

- When possible, confined spaces should be identified with a posted sign which reads:

Caution: Confined Space.

- Only personnel trained and knowledgeable of the requirements of these Confined Space Entry Procedures will be authorized to enter a confined space or be a confined space observer.

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- A Confined Space entry Permit (CSEP) must be issued prior to the performance of any work within a confined space. The CSEP will become a part of the permanent and official record of the site.
- Natural ventilation shall be provided for the confined space prior to initial entry and for the duration of the CSEP. Positive/forced mechanical ventilation may be required. However, care should be taken to not spread contamination outside of the enclosed area.
- If flammable liquids may be contained within the confined space, explosion proof equipment will be used. All equipment shall be positively grounded.
- The contents of any confined space shall, where necessary, be removed prior to entry. All sources of ignition must be removed prior to entry.
- Hand tools used in confined spaces shall be in good repair explosion proof and spark proof, and selected according to intended use. Where possible, pneumatic power tools are to be used.
- Hand-held lights and other illumination utilized in confined spaces shall be equipped with guards to prevent contact with the bulb and must be explosion proof.
- Compressed gas cylinders, except cylinders used for self-contained breathing apparatus, shall not be taken into confined spaces. Gas hoses shall be removed from the space and the supply turned off at the cylinder valve when personnel exit from the confined space.
- If a confined space requires respiratory equipment or where rescue may be difficult, safety belts, body harnesses and lifelines will be used. The outside observer shall be provided with the same equipment as those working within the confined space.
- A ladder is required in all confined spaces deeper than the employee's shoulders. The ladder shall be secured and not removed until all employees have exited the space.
- Only self-contained breathing apparatus or NIOSH approved airline respirators equipped with a 5-minute emergency air supply (egress bottle) shall be used in untested confined spaces or in any confined space with conditions determined immediately dangerous to life and health.
- Where air-moving equipment is used to provide ventilation, chemicals shall be removed from the vicinity to prevent introduction into the confined space.

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- Vehicles shall not be left running near confined space work or near air-moving equipment being used for confined space ventilation.
- Smoking in confined spaces will be prohibited at all times.
- Any deviation from these Confined Space Entry Procedures requires the prior approval of the Regional Safety Officer.

11.3 Procedure for Confined Space Entry

The HSO and Entry Team shall:

- Evaluate the job to be done and identify the potential hazards before a job in a confined space is scheduled.
- Ensure that all process piping, mechanical and electrical equipment, etc., have been disconnected, purged, blanked-off or locked and tagged as necessary.
- If possible, ensure removal of any standing fluids that may produce toxic or air displacing gases, vapors, or dust.
- Initiate a Confined Space Entry Permit (CSEP) in concurrence with the project manager or designated alternative.
- Ensure that any hot work (welding, burning, open flames, or spark producing operation) that is to be performed in the confined space has been approved by the project manager and is indicated on the CSEP.
- Ensure the space is ventilated before starting work in the confined space and for the duration of the time that the work is to be performed in the space.
- Ensure that the personnel who enter the confined space and the confined space observer helper are familiar with the contents and requirements of this instruction.
- Ensure remote atmospheric testing of the confined space prior to employee entry and before validation/revalidation of a CSEP to ensure the following:
 1. Oxygen content between 19.5% - 23.0%.
 2. No concentration of combustible gas in the space.

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3. Sampling will be done throughout the confined space and specifically at the lowest point in the space.
4. The absence of other atmospheric contaminants, space has contained toxic, corrosive, or irritant material.

IF REMOTE TESTING IS NOT POSSIBLE, LEVEL B PPE IS REQUIRED.

- Designate whether hot or cold work will be allowed. If all tests in a. through c. in IV 8 are satisfactory, complete the CSEP listing any safety precautions, protective equipment, or other requirements.
- Ensure that a copy of the CSEP is posted at the work site a copy is filed with the project supervisor, and a copy is furnished to the project manager.
- The CSEP shall be considered void if work in the confined space does not start within one hour after the tests in IV 8 are performed or if significant changes within the confined space atmosphere or job scope occur.
- The CSEP posted at the work site shall be removed at the completion of the job or the end of the shift, whichever is first.

11.4 Confined Space Observer

While personnel are inside the confined space, a confined space observer will monitor the activities and provide external assistance to those in the space. The observer will have no other duties that may take his attention away from the work or require him to leave the vicinity of the confined space at any time while personnel are in the space.

The confined space observer shall maintain at least voice contact with all personnel in the confined space. Visual contact is referred, if possible.

The observer shall be instructed by his supervisor in the method for contacting rescue personnel in the event of an emergency.

If the observer detects irregularities within the space, personnel within the space will be ordered to exit.

In the event of an emergency, the observer must NEVER enter the confined space prior to contacting and receiving assistance from a helper. Prior to this time, he should attempt to remove personnel with the lifeline and to perform all other rescue functions from outside the space. A helper shall be

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designated to provide assistance to the confined space observer in case the observer must enter the confined space to retrieve personnel.

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12.0 FREQUENCY AND TYPES OF AIR MONITORING/SAMPLING

This section explains the general concepts of an air monitoring program and specifies the surveillance activities that will take place during project completion at the Site. The purpose of air monitoring is to identify and quantify airborne contaminants in order to verify and determine the level of worker protection needed. Initial screening for identification is often qualitative; i.e., the contaminant, or the class to which it belongs, is demonstrated to be present but the determination of its concentration (quantification) must wait subsequent testing. Two principal approaches are available for identifying and/or quantifying airborne contaminants:

1. The on-site use of direct reading instruments.
2. Laboratory analysis of air samples obtained by gas sampling bag, collection media (i.e., filter, sorbent), and/or wet-contaminant collection methods.

12.1 *Direct Reading Monitoring Instruments*

Unlike air sampling devices, which are used to collect samples for subsequent analysis in a laboratory, direct-reading instruments provide information at the time of sampling, enabling rapid decision-making. Data obtained from the real-time monitors are used to assure proper selection of personnel protection equipment, engineering controls, and work practices. Overall, the instruments provide the user the capability to determine if site personnel are being exposed to concentrations which exceed exposure limits or action levels for specific hazardous materials.

Of significant importance, especially during initial entries, is the potential for IDLH conditions or oxygen deficient atmospheres. Real-time monitors can be useful in identifying any IDLH conditions, toxic levels of airborne contaminants, flammable atmospheres, or radioactive hazards. Periodic monitoring of conditions is critical, especially if exposures may have increased since initial monitoring or if new site activities have commenced.

Table 4: Direct Reading Instruments for General Survey

Instrument Name	Hazard Monitored	Principle of Operation	Instrument Example
Five-Gas Monitor	Explosive Atmosphere Oxygen Content Carbon Monoxide Hydrogen Sulfide Organic/Inorganic Cmpds.	Pellistor Diffusion (Wheatstone Bridge) Electrochemical Electrochemical Electrochemical Photoionization (10.6eV)	Multi-Rae Plus
Flame Ionization Detector	Organic compounds having Ion Potentials < 15.4	Flame Ionization	PE Photovac MicroFID
Geiger Type Radiation Detector	Alpha, Beta, Gamma, X-Ray Radiation	Ionization	Ludlum
NaI Scintillation Detector	Gamma, X-Ray Radiation	Light Scintillation	Ludlum Micro-R
Monitox	Single-gas detector	Electrochemical	MDA Drager
Photoionization Detector	Organic and Inorganic compounds having Ion Potentials < 11.6 depending on lamp size.	Photoionization	hNU MicroTip
Colorimetric Tubes	Specific gases or vapors	Chemical reaction	Drager
Infrared Spectrophotometer	Organic and Inorganic gases and vapors	Infrared Absorption	Foxboro Miran
Aerosol Monitor	Particulates and Dust	Light Refraction	MIE Miniram MIE Personal Data Ram MIE Data Ram

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Table 5: Action Levels

<i>Explosive Limits</i>	
Action Level	Action to Take
<10% LEL	Continue Investigation
10% - 20% LEL	Continue on-site monitoring with extreme caution as higher levels are encountered.
>20% LEL	Explosion hazard. Withdraw from area immediately.
<i>Oxygen Content</i>	
Action Level	Action to Take
<19.5%	Continue monitoring. Don Self Contained Breathing Apparatus.
>19.5% to >23.5%	Continue investigation with caution. Deviation from normal level may be due to presence of other substances.
>23.5%	Fire hazard potential. Discontinue investigation.
<i>Unknown Organic/Inorganic Vapors (Sustained Reading as measured with PID and/or FID)</i>	
Action Level	Action to Take
0 – 5 Units above Background	Don Level "C" Respiratory Protection
5 – 500 Units above Background	Don Level "B" Respiratory Protection
<i>Known Organic/Inorganic Vapor (Based on Limiting Contaminant)</i>	
Action Level	Action to Take
Action Level is ½ of PEL for material	Don Level "C" Respiratory Protection
	Don Level "B" Respiratory Protection
<i>Particulate Matter (Total Dust)</i>	
Action Level	Action to Take
30 µg/m ³	Don Level "C" Respiratory Protection
	Don Level "B" Respiratory Protection
<i>Asbestos</i>	
Action Level	Action to Take
0.1 f/cc	Don Level "C" Respiratory Protection or Powered Air Purifying Respirator (PAPR)
<i>Lead</i>	
Action Level	Action to Take
30 µg/m ³	Don Level "C" Respiratory Protection or Powered Air Purifying Respirator (PAPR)

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Reporting Format

- Field notebook
- Air monitoring
- Field data sheets
- Trip report
- Instrument datalogger

Table 6: Air Sampling Methods

Contaminant	NIOSH, OSHA or EPA Sample Method	Sample Media	Sample Pump	Sample Flow Rate
Lead	NIOSH 7300	37 mm 0.8µm Mixed Cellulose Ester Filter	Gillian HFS 113 or equivalent	1lpm to 4lpm

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13.0 Site Hazard Communication Plan

13.1 Introduction

This section has been prepared pursuant to 29 CFR 1910.1200, Hazard Communication, and will be implemented in conjunction with the 12th Street Landfill/Dump Site Safety Plan. The training program is detailed in 29 CFR 1910.1200.

13.2 General Information

All personnel working at the 12th Street Landfill/Dump Site are included in this program. The written program is included as part of the Site Safety Plan and is available in the command post for review by any interested employee.

13.3 Container Labeling

The Site Safety Officer will verify that all containers received for use in field operations or related activities will:

- Be clearly labeled as to the contents;
- Note the appropriate hazard warning; and,
- List the names and addresses of the manufacturers.

The Site Safety Officer will ensure that all secondary containers are labeled with a copy of the original manufacturer's label or with a generic label that identifies the hazardous ingredients in the chemical or mixture. Portable containers into which hazardous chemicals are transferred from labeled containers, and which are intended only for immediate use of the person who performs the transfer, need not be labeled.

13.4 Material Safety Data Sheets (MSDS)

The 12th Street Landfill/Dump Site Safety Officer will be responsible for monitoring the MSDS system, including establishing and monitoring the procedures for obtaining MSDSs. The Safety Officer will be responsible for ensuring that site specific materials be included in its chemical inventories and MSDSs provided on all temporary work sites. If MSDSs are not readily available, then a data sheet generated from the Hazardous Substances DataBase (HSDB) or similar on-line service may be substituted. Copies of MSDSs for hazardous substances used on site will be included as an appendix to the Site Safety Plan. The site safety plan is available to all employees.

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13.5 Employee Training and Information

The Site Safety Officer will be responsible for developing, implementing and monitoring the employee training and information program at the 12th Street Landfill/Dump Site.

Prior to starting work, each new site employee will attend a health and safety orientation and will receive information and training on the following:

- An overview of the requirements contained in the Hazard Communication Standard, 29 CFR 1910.1200;
- Chemicals present in their workplace operations;
- Location and availability of the 12th Street Landfill/Dump Site written hazard communication program;
- Physical and health effects of any hazardous chemicals;
- Methods and observation techniques used to determine the presence or release of hazardous chemicals in the work area;
- How to lessen or prevent exposure to these hazardous chemicals through usage of control / work practices and personal protective equipment.
- Steps that the site has taken to lessen/prevent exposure to these chemicals;
- Emergency procedures to follow if they are exposed to these chemicals;
- How to read labels and review MSDSs to obtain hazard information;
- Location of the MSDS file and location of hazardous chemical list.

After attending the training class, each employee will sign the Site Safety Plan/Hazard Communication Plan Acknowledgment Form. Prior to a new chemical hazard at the 12th Street Landfill/Dump Site, each employee will be given information on the new chemicals. The Site Safety Officer or the site lead is responsible for ensuring that new chemicals are tracked and information made available.

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13.5 List of Hazardous Chemicals

Following is a list of chemicals typically used on any project for sample preservation, fueling equipment, etc.:

1. Sample Preservatives
 - Hydrochloric Acid (sample preservative)
 - Nitric Acid (sample preservative)
 - Sodium Hydroxide
2. Breathing Air
3. Calibration Gases and Instrument Fuel
 - Calibration Gas mixture – Multi-Rae Plus
 - Isobutylene Calibration Gas – Multi-Rae Plus
 - Methane Calibration Gas – PE Photovac MicroFID
 - FID Fuel - Hydrogen
4. Maintenance Products
 - Gasoline
 - Diesel Fuel
 - WD-40 Penetrant
 - Motor Oil
5. Welding Gases
 - Oxygen
 - Acetylene
6. Confined Space Inerting Gases
 - Carbon Dioxide, Solid (Dry Ice)
 - Carbon Dioxide Gas
 - Nitrogen
7. Miscellaneous Materials
 - White-Out
 - Mean-Streak Marker
 - Krazy-Glue
 - Copy Toner
 - Cleaner-Sanitizer for protective masks
 - Lead Acid Battery (Sealed)
 - Lead Acid Battery (Vented)
 - Nickel Cadmium Battery (NICAD)
 -

The following is a list of chemicals found in site operations:

1. Lead
2. Arsenic
3. Phenol
4. Toluene

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MSDSs for these chemicals are to be found in Appendix B.

13.6 Hazardous Non-Routine Tasks

It is the 12th Street Landfill/Dump Site policy that no employee will make a confined space entry on any non-routine task or response action without first receiving a safety briefing from the Site Safety Officer. Information to be provided to employees is as follows:

- Specific chemical hazards;
- Protective / safety measures the employee is required to take;
- Measures the site has taken to lessen the hazards, including ventilation, respirators, presence of another employee and emergency procedures.

13.7 Informing Contractors

At the 12th Street Landfill/Dump Site, it is the responsibility of the Site Safety Officer to provide contractors (with employees on the site), the following information:

- Hazardous chemicals to which they may be exposed to while on the job or job site;
- Precautions the employees may take to lessen the possibility of exposure by usage of appropriate protective measures;
- Steps the site has taken to reduce exposure and thus lessen risk;
- Availability of MSDSs for all hazardous chemicals on file and where a copy may be obtained;
- Procedures to follow if employees are ever exposed.

At the 12th Street Landfill/Dump Site, each employer and its subcontractors that have employees reporting to the site shall inform the OSC or designated representative of all hazardous substances or materials brought to the site and provide MSDSs for these chemicals. The site safety officer shall be responsible for informing other site personnel and visitors of these chemicals. Each employer shall provide other employers with information about labeling systems and precautionary measures. MSDSs shall be stored in one conspicuous location accessible to all site personnel and visitors. If the duration of site work is one week or greater, each employer shall have a formal hazard communication plan in compliance with 1910.1200.

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Appendix A
Site Safety Plan and Hazard Communication Plan
Acknowledgment

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Site Safety Plan and Hazard Communication Plan Acknowledgment

Name (Print)	Signature	Organization	Date
James Cunane	James Cunane	Guardian	4/7/00
Sviatlana Wilson	S Wilson	Weston SATA	4/7/00
Bill Stephens	Bill Stephens	SECI	4/7/00
Tony McCardell	Tony McCardell	SECI	4/7/00
Mike Towle	Mike Towle	EPA	4/7/00
Brian Croft	Brian Croft	HEME	7/5/00
Libby Levy	Libby Levy	ATSDR	7/12/00
Robert Helverson	Robert Helverson	Tetra Tech	7/14/00
JAMES T Crosby	James T Crosby	Guardian	7/16/00
THOMAS J CUNANE	Thomas J Cunane	GUARDIAN	7/6/00
Jermaine Anderson	Jermaine Anderson	Guardian	8/14/00
Andrew Bell	Andrew Bell	Guardian	8/14/00
Dan Hebert	Dan Hebert	Guardian	8/14/00
Bruce D. Ensler	Bruce D Ensler	Geosco & Lynch	8/14/00
John J McAttee	John J McAttee	G+L	8/14/00
Ken Bizaro	Ken Bizaro	GAL	8/14/00
Tony Cooper	Tony Cooper	Guardian	8/14/00
Robert Thom	Robert Thom	Guardian	8/30/00
Myles Bortos	Myles Bortos	START	9/18/00
DOUG FOX	US EPA Supply Point	USEPA	10/10/00
James Wright	James Wright	EPA	10/10/00
Brian Butte	Brian Butte	Guardian	12/4/00
Bob Thomas	Bob Thomas	Guardian	12/4/00
Joseph Roberts	Joseph Roberts	GES	12/14/00
Don Amadorino	Don Amadorino	GES	2/20/01
AL TOTO	AL TOTO	GES	2/21/01
Roger Strader	Roger Strader	GES	2/21/01

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[illegible]

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Appendix B

Material Safety Data Sheets

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International Chemical Safety Cards

ARSENIC

ICSC: 0013

ARSENIC
 Grey arsenic
 Metallic arsenic
 As
 Atomic mass: 74.9

CAS # 7440-38-2
 RTECS # CG0525000
 ICSC # 0013
 UN # 1558
 EC # 033-001-00-X

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames. NO contact with strong oxidizers. NO contact with hot surfaces.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Risk of fire and explosion is slight if in the form of fine powder or dust when exposed to hot surfaces or flames.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
• INHALATION	Cough. Diarrhoea. Shortness of breath. Sore throat. Vomiting. Weakness. Grey skin.	Closed system and ventilation.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
• SKIN	Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
• EYES	Redness.	or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION	Diarrhoea. Nausea. Sore throat. Unconsciousness. Vomiting (further see Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.
SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING	
Evacuate danger area! Sweep spilled substance into sealable containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment (extra personal protection: complete	Provision to contain effluent from fire extinguishing. Separated from strong oxidants, acids, halogens, food and feedstuffs. Well closed. Keep in a well-ventilated room.	Do not transport with food and feedstuffs. T symbol R: 23/25 S: (1/2-)20/21-28-45 UN Hazard Class: 6.1	

protective clothing including self-contained breathing apparatus).

UN Ticking Group: II
Marine pollutant.

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0013

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993

International Chemical Safety Cards

ARSENIC

ICSC: 0013

I M P O R T A N T	<p>PHYSICAL STATE; APPEARANCE: ODOURLESS, BRITTLE, GREY, METALLIC-LOOKING CRYSTALS.</p> <p>PHYSICAL DANGERS:</p> <p>CHEMICAL DANGERS: Upon heating, toxic fumes are formed. Reacts violently with strong oxidants and halogens causing fire and explosion hazard. Reacts with nitric acid, hot sulfuric acid. Toxic arsine gas may be formed in contact with acid or acidic substances and certain metals, such as galvanized or light metals.</p> <p>OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV: ppm; 0.01 mg/m³ (as TWA) A1 (ACGIH 1994-1995).</p>	<p>ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation of its aerosol, through the skin and by ingestion.</p> <p>INHALATION RISK: Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.</p> <p>EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes, the skin and the respiratory tract. The substance may cause effects on the circulatory system, nervous system, kidneys and gastrointestinal tract, resulting in convulsions, kidney impairment, severe hemorrhage, losses of fluids, and electrolytes, shock and death. Exposure may result in death. The effects may be delayed. Medical observation is indicated.</p> <p>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: Repeated or prolonged contact with skin may cause dermatitis. Repeated or prolonged contact may cause skin sensitization. The substance may have effects on the mucous membranes, skin, kidneys, liver, resulting in neuropathy, pigmentation disorders, perforation of nasal septum and tissue lesions. This substance is carcinogenic to humans.</p>
	<p>PHYSICAL PROPERTIES</p> <p>Sublimation point: 613°C Relative density (water = 1): 5.7</p>	<p>Solubility in water: none</p>
	<p>ENVIRONMENTAL DATA</p> <p>The substance is toxic to aquatic organisms. It is strongly advised not to let the chemical enter into the environment because it persists in the environment.</p>	
	<p>NOTES</p> <p>The substance is combustible but no flash point is available in literature. Depending on the degree of exposure, periodic medical examination is indicated. Do NOT take working clothes home. Refer also to cards for specific arsenic compounds, e.g., Arsenic pentoxide (ICSC # 0377), Arsenic trichloride (ICSC # 0221), Arsenic trioxide (ICSC # 0378), Arsine (ICSC # 0222).</p>	

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ADDITIONAL INFORMATION	
ICSC: 0013	ARSENIC
© IPCS, CEC, 1993	

IMPORTANT LEGAL NOTICE:	Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use.
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MSDS**Material Safety Data Sheet**

24 Hour Emergency Telephone: 908-858-2151
CHEMTREC: 1-800-424-9300

National Response In Canada
CANUTEC: 613-996-6668

Outside U.S. and Canada
Chemtrec: 202-483-7516

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

MALLINCKRODT

NOTE: CHEMTREC, CANUTEC and National
Response Center emergency numbers to be
used only in the event of chemical emergencies
involving a spill, leak, fire, exposure or accident
involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

LEAD METAL

MSDS Number: L2347 --- Effective Date: 11/17/99

1. Product Identification

Synonyms: Granular lead, pigment metal; C.I. 77575

CAS No.: 7439-92-1

Molecular Weight: 207.19

Chemical Formula: Pb

Product Codes:

J.T. Baker: 2256, 2266

Mallinckrodt: 5668

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Lead	7439-92-1	95 - 100%	Yes

3. Hazards Identification

Emergency Overview

**POISON! DANGER! MAY BE FATAL IF SWALLOWED OR INHALED.
CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.
NEUROTOXIN. AFFECTS THE GUM TISSUE, CENTRAL NERVOUS
SYSTEM, KIDNEYS, BLOOD AND REPRODUCTIVE SYSTEM. POSSIBLE**

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CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

--

Health Rating: 3 - Severe (Life)

Flammability Rating: 0 - None

Reactivity Rating: 0 - None

Contact Rating: 1 - Slight

Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES

Storage Color Code: Blue (Health)

--

Potential Health Effects

Inhalation:

Lead can be absorbed through the respiratory system. Local irritation of bronchia and lungs can occur and, in cases of acute exposure, symptoms such as metallic taste, chest and abdominal pain, and increased lead blood levels may follow. See also Ingestion.

Ingestion:

POISON! The symptoms of lead poisoning include abdominal pain and spasms, nausea, vomiting, headache. Acute poisoning can lead to muscle weakness, "lead line" on the gums, metallic taste, definite loss of appetite, insomnia, dizziness, high lead levels in blood and urine with shock, coma and death in extreme cases.

Skin Contact:

Lead and lead compounds may be absorbed through the skin on prolonged exposure; the symptoms of lead poisoning described for ingestion exposure may occur. Contact over short periods may cause local irritation, redness and pain.

Eye Contact:

Absorption can occur through eye tissues but the more common hazards are local irritation or abrasion.

Chronic Exposure:

Lead is a cumulative poison and exposure even to small amounts can raise the body's content to toxic levels. The symptoms of chronic exposure are like those of ingestion poisoning; restlessness, irritability, visual disturbances, hypertension and gray facial color may also be noted.

Aggravation of Pre-existing Conditions:

Persons with pre-existing kidney, nerve or circulatory disorders or with skin or eye problems may be more susceptible to the effects of this substance.

4. First Aid Measures

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Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Ingestion:

Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.

Skin Contact:

Immediately flush skin with plenty of soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Not considered to be a fire hazard. Powder/dust is flammable when heated or exposed to flame.

Explosion:

Not considered to be an explosion hazard.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire. Do not allow water runoff to enter sewers or waterways.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Can produce toxic lead fumes at elevated temperatures and also react with oxidizing materials.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Sweep up and containerize for reclamation or disposal. Vacuuming or wet sweeping may be used to avoid dust dispersal. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against

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physical damage. Isolate from incompatible substances. Areas in which exposure to lead metal or lead compounds may occur should be identified by signs or appropriate means, and access to the area should be limited to authorized persons. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

For lead, metal and inorganic dusts and fumes, as Pb:

-OSHA Permissible Exposure Limit (PEL): 0.05 mg/m³ (TWA)

For lead, elemental and inorganic compounds, as Pb:

-ACGIH Threshold Limit Value (TLV): 0.05 mg/m³ (TWA), A3 animal carcinogen

ACGIH Biological Exposure Indices (BEI): 30 ug/100ml, notation B (see actual Indices for more information).

For lead, inorganic:

-NIOSH Recommended Exposure Limit (REL): 0.1 mg/m³ (TWA)

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, a half-face high efficiency dust/mist respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece high efficiency dust/mist respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator.

WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

Other Control Measures:

Eating, drinking, and smoking should not be permitted in areas where solids or liquids containing lead compounds are handled, processed, or stored. See OSHA substance-specific standard for more information on personal protective equipment, engineering and work practice controls, medical surveillance, record keeping, and reporting requirements. (29 CFR 1910.1025).

9. Physical and Chemical Properties

Appearance:

Small, white to blue-gray metallic shot or granules.

Odor:

Odorless.

Solubility:

Insoluble in water.

Density:

11.34

pH:

No information found.

% Volatiles by volume @ 21C (70F):

0

Boiling Point:

1740C (3164F)

Melting Point:

327.5C (622F)

Vapor Density (Air=1):

No information found.

Vapor Pressure (mm Hg):

1.77 @ 1000C (1832F)

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

Does not decompose but toxic lead or lead oxide fumes may form at elevated temperatures.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Ammonium nitrate, chlorine trifluoride, hydrogen peroxide, sodium azide, zirconium, disodium acetylde, sodium acetylde and oxidants.

Conditions to Avoid:

Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Toxicological Data:

Investigated as a tumorigen, mutagen, reproductive effector.

Reproductive Toxicity:

Lead and other smelter emissions are human reproductive hazards. (Chemical Council on Environmental Quality; Chemical Hazards to Human Reproduction, 1981).

Carcinogenicity:

EPA / IRIS classification: Group B2 - Probable human carcinogen, sufficient animal evidence.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Lead (7439-92-1)	No	No	2B

12. Ecological Information

Environmental Fate:

When released into the soil, this material is not expected to leach into groundwater. This material may bioaccumulate to some extent.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----				
Ingredient	TSCA	EC	Japan	Australia
Lead (7439-92-1)	Yes	Yes	Yes	Yes
-----\Chemical Inventory Status - Part 2\-----				
--Canada--				

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Ingredient	Korea	DSL	NDSL	Phil.
Lead (7439-92-1)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----				
Ingredient	-SARA 302-	-----SARA 313-----		
	RQ	TPQ	List	Chemical Catg.
Lead (7439-92-1)	No	No	Yes	No

-----\Federal, State & International Regulations - Part 2\-----			
Ingredient	CERCLA	-RCRA-	-TSCA-
		261.33	8 (d)
Lead (7439-92-1)	10	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
 SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
 Reactivity: No (Pure / Solid)

WARNING:

THIS PRODUCT CONTAINS CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: No information found.

Poison Schedule: S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 3 Flammability: 1 Reactivity: 0

Label Hazard Warning:

POISON! DANGER! MAY BE FATAL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. NEUROTOXIN. AFFECTS THE GUM TISSUE, CENTRAL NERVOUS SYSTEM, KIDNEYS, BLOOD AND REPRODUCTIVE SYSTEM. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.

Label Precautions:

Do not get in eyes, on skin, or on clothing.
 Do not breathe dust.
 Keep container closed.
 Use only with adequate ventilation.
 Wash thoroughly after handling.

Label First Aid:

If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of

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contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

Product Use:

Laboratory Reagent.

Revision Information:

No changes.

Disclaimer:

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

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MSDS**Material Safety Data Sheet**

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

MALLINCKRODT

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-562-2537) for assistance.

PHENOL, CRYSTALS

MSDS Number: P1949 --- Effective Date: 09/08/97

1. Product Identification

Synonyms: Carboic acid; Phenic acid; Phenylic acid; Hydroxybenzene; Phenol, fused; Monohydroxybenzene; Phenol, solid

CAS No.: 108-95-2

Molecular Weight: 94.11

Chemical Formula: C₆H₅OH

Product Codes:

J.T. Baker: 2858, 2862, 4056

Mallinckrodt: 0028, 0052, 0273, 0605, H602

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Phenol	108-95-2	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

POISON! DANGER! MAY BE FATAL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. RAPIDLY ABSORBED THROUGH SKIN. CORROSIVE. CAUSES SEVERE BURNS TO EVERY AREA OF CONTACT.

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**AFFECTS CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS.
COMBUSTIBLE.****J.T. Baker SAF-T-DATA^(tm) Ratings** (Provided here for your convenience)-----
--

Health Rating: 3 - Severe (Life)

Flammability Rating: 2 - Moderate

Reactivity Rating: 1 - Slight

Contact Rating: 4 - Extreme (Corrosive)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD;
PROPER GLOVES; CLASS B EXTINGUISHERStorage Color Code: Red Stripe (Store Separately)

--**Potential Health Effects**

The major hazard of phenol is its ability to penetrate the skin rapidly, particularly when liquid, causing severe injury which can be fatal. Phenol also has a strong corrosive effect on body tissue causing severe chemical burns. Due to its local anesthetizing properties, skin burns may be painless.

Inhalation:

Breathing vapor, dust or mist results in digestive disturbances (vomiting, difficulty in swallowing, diarrhea, loss of appetite). Will irritate, possibly burn respiratory tract. Other symptoms listed under ingestion may also occur.

Ingestion:

Poison. Symptoms may include burning pain in mouth and throat, abdominal pain, nausea, vomiting, headache, dizziness, muscular weakness, central nervous system effects, increase in heart rate, irregular breathing, coma, and possibly death. Acute exposure is also associated with kidney and liver damage. Ingestion of 1 gram has been lethal to humans.

Skin Contact:

Corrosive. Rapidly absorbed through the skin with systemic poisoning effects to follow. Discoloration and severe burns may occur, but may be disguised by a loss in pain sensation.

Eye Contact:

Corrosive. Eye burns with redness, pain, blurred vision may occur. May cause severe damage and blindness.

Chronic Exposure:

Repeated exposure may cause symptoms described for acute poisoning as well as eye and skin discoloration.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin, eye or central nervous system disorders, or impaired liver, kidney, or pulmonary function may be more susceptible to the effects of this substance.

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4. First Aid Measures

IN CASE OF PHENOL POISONING, start first aid treatment immediately, then get medical attention. People administering first aid should take precautions to avoid contact with phenol. A phenol antidote kit (castor oil or other vegetable oil, polyethylene glycol 300) should be available in any phenol work area. Actions to be taken in case of phenol poisoning should be planned and practiced before beginning work with phenol. Castor oil and or polyethylene glycol can be given by a first responder before medical help arrives.

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Ingestion:

If swallowed, immediately administer castor oil or other vegetable oil. Never give anything by mouth to an unconscious person. Be ready to induce vomiting at the advice of physician or poison control center. Castor oil (or vegetable oil) dosage should be between 15 and 30 cc. Get medical attention immediately.

Skin Contact:

In case of skin contact, immediately flush skin with large amounts of water while removing contaminated clothing and shoes. As soon as possible, repeatedly apply polyethylene glycol to affected area. Destroy contaminated clothing and shoes. Flush skin with water for at least 30 minutes. It is very important to avoid rubbing or wiping affected parts which would aggravate irritation and cause product dispersion. Continue treatment until the burned area changes color from white to pink. Expect that this can take a long period of time (20 minutes or more). The polyethylene glycol application should be done during transportation to the hospital. If polyethylene glycol is not available, flush with water for at least 30 minutes prior to going to hospital. Get medical attention immediately.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:

Treat ingestion with gastric lavage using 40% aqueous Bacto-Peptune, milk or water until phenolic odor is eliminated. Then give 15 to 50 cc castor or vegetable oil. Debride necrotic skin. Monitor vital signs, fluid status, electrolytes, BUN, renal and hepatic function, and electrocardiogram. Manage sedation, seizures, renal failure, and fluid electrolyte imbalances symptomatically as indicated.

5. Fire Fighting Measures

Fire:

Flash point: 79C (174F) CC

Autoignition temperature: 715C (1319F)

Flammable limits in air % by volume:

lcl: 1.3; ucl: 8.6

Combustible. Contact with strong oxidizers may cause fire.

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Explosion:

Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Sealed containers may rupture when heated.

Fire Extinguishing Media:

Water spray, dry chemical, alcohol foam, or carbon dioxide. Water spray may be used to keep fire exposed containers cool.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Structural firefighter's protective clothing is ineffective for fires involving this material. Stay away from sealed containers.

6. Accidental Release Measures

Remove all sources of ignition. Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Clean up spills in a manner that does not disperse dust into the air. Use non-sparking tools and equipment. Reduce airborne dust and prevent scattering by moistening with water. Pick up spill for recovery or disposal and place in a closed container. Do not flush to the sewer. Dry lime or soda ash may be used on spill for neutralization. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container. Store in a cool, dry, ventilated area away from sources of heat or ignition. Protect against physical damage. Store separately from reactive or combustible materials, and out of direct sunlight. Avoid dust formation and control ignition sources. Employ grounding, venting and explosion relief provisions in accord with accepted engineering practices in any process capable of generating dust and/or static electricity. Empty only into inert or non-flammable atmosphere. Emptying contents into a non-inert atmosphere where flammable vapors may be present could cause a flash fire or explosion due to electrostatic discharge. All phenol workers should be properly trained on its hazards and the proper protective measures required. This training should also include emergency actions. All phenol operations should be enclosed to eliminate any potential exposure routes. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

Phenol:

-OSHA Permissible Exposure Limit (PEL):

5 ppm (TWA) (skin)

-ACGIH Threshold Limit Value (TLV):

5 ppm (TWA) (skin)

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, a full facepiece respirator with organic vapor cartridge and dust/mist filter may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Butyl rubber and neoprene are suitable materials for personal protective equipment.

Eye Protection:

Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Colorless to light pink crystals.

Odor:

Sharp, medicinal, sweet, tarry.

Solubility:

1 g/15 ml of water; very soluble in alcohol.

Specific Gravity:

1.06 @ 20C/4C

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

182C (360F)

Melting Point:

43C (109F)

Vapor Density (Air=1):

3.2

Vapor Pressure (mm Hg):

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0.4 @ 20C (68F)

Evaporation Rate (BuAc=1):

< 0.01

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Heat will contribute to instability.

Hazardous Decomposition Products:

Carbon dioxide and carbon monoxide may form when heated to decomposition. Toxic gases and vapors may be released if involved in a fire.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Oxidizers, aluminum chloride and nitrobenzene, calcium hypochlorite, butadiene, halogens, formaldehyde, mineral oxidizing acids, isocyanates, sodium nitrite and many other materials. Hot liquid phenol will attack aluminum, magnesium, lead, and zinc metals.

Conditions to Avoid:

Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Oral rat LD50: 317 mg/Kg; skin rabbit LD50:630 mg/kg; inhalation rat LC50: 316 mg/m3; irritation data: skin rabbit, standard Draize, 500 mg/24H severe; eye rabbit, standard Draize 5 mg/30S rinse, mild. Investigated as a tumorigen, mutagen, reproductive effector.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Phenol (108-95-2)	No	No	3

12. Ecological Information

Environmental Fate:

When released into the soil, this material is expected to readily biodegrade. When released into the soil, this material is not expected to leach into groundwater. When released into the soil, this material may evaporate to a moderate extent. When released into the soil, this material is expected to have a half-life between 1 and 10 days. When released into water, this material is expected to readily biodegrade. When released into water, this material is not expected to evaporate significantly. When released into water, this material is expected to have a half-life between 10 and 30 days. This material has an estimated

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bioconcentration factor (BCF) of less than 100. This material is not expected to significantly bioaccumulate. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material may be moderately degraded by photolysis. When released into the air, this material is expected to have a half-life of less than 1 day.

Environmental Toxicity:

This material is expected to be toxic to aquatic life. The LC50/96-hour values for fish are between 10 and 100 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: PHENOL, SOLID

Hazard Class: 6.1

UN/NA: UN1671

Packing Group: II

Information reported for product/size: 2KG

International (Water, I.M.O.)

Proper Shipping Name: PHENOL, SOLID

Hazard Class: 6.1

UN/NA: UN1671

Packing Group: II

Information reported for product/size: 2KG

International (Air, I.C.A.O.)

Proper Shipping Name: PHENOL, SOLID

Hazard Class: 6.1

UN/NA: UN1671

Packing Group: II

Information reported for product/size: 2KG

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15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----
 Ingredient TSCA EC Japan Australia

Phenol (108-95-2) Yes Yes Yes Yes

-----\Chemical Inventory Status - Part 2\-----

Ingredient Korea DSL NDSL Phil.

Phenol (108-95-2) Yes Yes No Yes

-----\Federal, State & International Regulations - Part 1\-----

Ingredient -SARA 302- -SARA 313-
 RQ TPQ List Chemical Catg.

Phenol (108-95-2) 1000 500* Yes No

-----\Federal, State & International Regulations - Part 2\-----

Ingredient CERCLA -RCRA- -TSCA-
 261.33 8(d)

Phenol (108-95-2) 1000 U188 No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
 SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
 Reactivity: No (Pure / Solid)

Australian Hazchem Code: 2X

Poison Schedule: S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 4 Flammability: 2 Reactivity: 0

Label Hazard Warning:

POISON! DANGER! MAY BE FATAL IF SWALLOWED, INHALED OR
 ABSORBED THROUGH SKIN. RAPIDLY ABSORBED THROUGH SKIN.
 CORROSIVE. CAUSES SEVERE BURNS TO EVERY AREA OF CONTACT.
 AFFECTS CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS.
 COMBUSTIBLE.

Label Precautions:

Do not breathe dust.
 Do not get in eyes, on skin, or on clothing.
 Keep container closed.
 Use only with adequate ventilation.

Wash thoroughly after handling.
Keep away from heat, sparks and flame.

Label First Aid:

IN ALL CASES, GET MEDICAL ATTENTION IMMEDIATELY. KEEP A PHENOL ANTIDOTE KIT in area of product use or storage. Administer castor oil and/or polyethylene glycol per pre-planned directions. If swallowed, immediately administer castor oil or other vegetable oil. Never give anything by mouth to an unconscious person. In case of skin contact, immediately flush skin with large amounts of water while removing contaminated clothing and shoes. As soon as possible, repeatedly apply polyethylene glycol to affected area. Destroy contaminated clothing and shoes. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of eye contact, immediately flush eyes with plenty of water for at least 15 minutes while lifting lower and upper eyelids.

Product Use:

Laboratory Reagent.

Revision Information:**Disclaimer:**

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

Please reduce your browser font size for better viewing and printing.

MSDS**Material Safety Data Sheet**

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

MALLINCKRODT

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6668

Outside U.S. and Canada
Chemtec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-562-2537) for assistance.

TOLUENE

MSDS Number: T3913 --- *Effective Date: 11/17/99*

1. Product Identification

Synonyms: Methylbenzene; Toluol; Phenylmethane

CAS No.: 108-88-3

Molecular Weight: 92.14

Chemical Formula: C₆H₅-CH₃

Product Codes:

J.T. Baker: 5375, 5584, 5809, 5812, 9336, 9351, 9364, 9456, 9457, 9459, 9460, 9462, 9466, 9472, 9476

Mallinckrodt: 4483, 8091, 8092, 8604, 8605, 8608, 8610, 8611, V560

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Toluene	108-88-3	100%	Yes

3. Hazards Identification

Emergency Overview

POISON! DANGER! HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. VAPOR HARMFUL. FLAMMABLE LIQUID AND VAPOR. MAY AFFECT LIVER, KIDNEYS,

BLOOD SYSTEM, OR CENTRAL NERVOUS SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

--

Health Rating: 2 - Moderate

Flammability Rating: 3 - Severe (Flammable)

Reactivity Rating: 0 - None

Contact Rating: 1 - Slight

Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES;
CLASS B EXTINGUISHER

Storage Color Code: Red (Flammable)

--

Potential Health Effects

Inhalation:

Inhalation may cause irritation of the upper respiratory tract. Symptoms of overexposure may include fatigue, confusion, headache, dizziness and drowsiness. Peculiar skin sensations (e. g. pins and needles) or numbness may be produced. Very high concentrations may cause unconsciousness and death.

Ingestion:

Swallowing may cause abdominal spasms and other symptoms that parallel over-exposure from inhalation. Aspiration of material into the lungs can cause chemical pneumonitis, which may be fatal.

Skin Contact:

Causes irritation. May be absorbed through skin.

Eye Contact:

Causes severe eye irritation with redness and pain.

Chronic Exposure:

Reports of chronic poisoning describe anemia, decreased blood cell count and bone marrow hypoplasia. Liver and kidney damage may occur. Repeated or prolonged contact has a defatting action, causing drying, redness, dermatitis. Exposure to toluene may affect the developing fetus.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or impaired liver or kidney function may be more susceptible to the effects of this substance. Alcoholic beverage consumption can enhance the toxic effects of this substance.

4. First Aid Measures

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. CALL A PHYSICIAN IMMEDIATELY.

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Ingestion:

Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately. If vomiting occurs, keep head below hips to prevent aspiration into lungs.

Skin Contact:

In case of contact, immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician immediately.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Flash point: 7C (45F) CC

Autoignition temperature: 422C (792F)

Flammable limits in air % by volume:

lcl: 3.3; ucl: 19

Flammable liquid and vapor!

Dangerous fire hazard when exposed to heat or flame. Vapors can flow along surfaces to distant ignition source and flash back.

Explosion:

Above flash point, vapor-air mixtures are explosive within flammable limits noted above.

Contact with strong oxidizers may cause fire or explosion. Sensitive to static discharge.

Fire Extinguishing Media:

Dry chemical, foam or carbon dioxide. Water may be used to flush spills away from exposures and to dilute spills to non-flammable mixtures.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Water spray may be used to keep fire exposed containers cool.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response

Center is (800) 424-8802.

J. T. Baker SOLUSORB(R) solvent adsorbent is recommended for spills of this product.

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

Toluene:

- OSHA Permissible Exposure Limit (PEL):
200 ppm (TWA); 300 ppm (acceptable ceiling conc.); 500 ppm (maximum conc.).
- ACGIH Threshold Limit Value (TLV):
50 ppm (TWA) skin, A4 - Not Classifiable as a Human Carcinogen.

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, a half-face organic vapor respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

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9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Aromatic benzene-like.

Solubility:

0.05 gm/100gm water @ 20C (68F).

Specific Gravity:

0.86 @ 20C / 4 C

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

111C (232F)

Melting Point:

-95C (-139F)

Vapor Density (Air=1):

3.14

Vapor Pressure (mm Hg):

22 @ 20C (68F)

Evaporation Rate (BuAc=1):

2.24

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Containers may burst when heated.

Hazardous Decomposition Products:

Carbon dioxide and carbon monoxide may form when heated to decomposition.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Heat, flame, strong oxidizers, nitric and sulfuric acids, chlorine, nitrogen tetroxide; will attack some forms of plastics, rubber, coatings.

Conditions to Avoid:

Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Toxicological Data:

Oral rat LD50: 636 mg/kg; skin rabbit LD50: 14100 uL/kg; inhalation rat LC50: 49 gm/m³/4H; Irritation data: skin rabbit, 500 mg, Moderate; eye rabbit, 2 mg/24H, Severe.

Investigated as a tumorigen, mutagen, reproductive effector.

Reproductive Toxicity:

Has shown some evidence of reproductive effects in laboratory animals.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Toluene (108-88-3)	No	No	3

12. Ecological Information

Environmental Fate:

When released into the soil, this material may evaporate to a moderate extent. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material may biodegrade to a moderate extent. When released into water, this material may evaporate to a moderate extent. When released into water, this material may biodegrade to a moderate extent. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life of less than 1 day. This material is not expected to significantly bioaccumulate. This material has a log octanol-water partition coefficient of less than 3.0. Bioconcentration factor = 13.2 (eels).

Environmental Toxicity:

This material is expected to be toxic to aquatic life. The LC50/96-hour values for fish are between 10 and 100 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: TOLUENE

Hazard Class: 3

UN/NA: UN1294

Packing Group: II

Information reported for product/size: 390LB

ORIGINAL

International (Water, I.M.O.)**Proper Shipping Name:** TOLUENE**Hazard Class:** 3.2**UN/NA:** UN1294**Packing Group:** II**Information reported for product/size:** 390LB**15. Regulatory Information**

-----\Chemical Inventory Status - Part 1\-----				
Ingredient	TSCA	EC	Japan	Australia
Toluene (108-88-3)	Yes	Yes	Yes	Yes

-----\Chemical Inventory Status - Part 2\-----				
Ingredient	Korea	DSL	--Canada-- NDSL	Phil.
Toluene (108-88-3)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----				
Ingredient	-SARA 302- RQ	TPQ	-SARA 313- List	Chemical Catg.
Toluene (108-88-3)	No	No	Yes	No

-----\Federal, State & International Regulations - Part 2\-----			
Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8 (d)
Toluene (108-88-3)	1000	U220	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes
 SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
 Reactivity: No (Pure / Liquid)

WARNING:

THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: 3[Y]E**Poison Schedule:** S6**WHMIS:**

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

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NFPA Ratings: Health: **2** Flammability: **3** Reactivity: **0**

Label Hazard Warning:

POISON! DANGER! HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. VAPOR HARMFUL. FLAMMABLE LIQUID AND VAPOR. MAY AFFECT LIVER, KIDNEYS, BLOOD SYSTEM, OR CENTRAL NERVOUS SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

Label Precautions:

Keep away from heat, sparks and flame.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Avoid breathing vapor.
Avoid contact with eyes, skin and clothing.

Label First Aid:

Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If vomiting occurs, keep head below hips to prevent aspiration into lungs. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician immediately.

Product Use:

Laboratory Reagent.

Revision Information:

No changes.

Disclaimer:

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Strategic Services Division

Phone Number: (314) 539-1600 (U.S.A.)

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J.T.BAKER INC. 222 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865
M A T E R I A L S A F E T Y D A T A S H E E T
24-HOUR EMERGENCY TELEPHONE -- (908) 359-2151
CHEMTREC # (800) 424-9300 -- NATIONAL RESPONSE CENTER # (300) 424-8802

HS096 -01 HYDROCHLORIC ACID, VOLUMETRIC SOLUTION

EFFECTIVE: 03/09/92

PAGE: 1
ISSUED: 03/28/92

J.T.BAKER INC., 222 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865

=====

SECTION I - PRODUCT IDENTIFICATION

=====

PRODUCT NAME: HYDROCHLORIC ACID, VOLUMETRIC SOLUTION
COMMON SYNONYMS: N/A
CHEMICAL FAMILY: VOLUMETRIC SOLUTIONS AND CONCENTRATES
FORMULA: HCL + H2O
FORMULA WT.: 36.46
CAS NO.: 7647-01-0
NIOSH/RTECS NO.: MH4025000
PRODUCT USE: LABORATORY REAGENT
PRODUCT CODES: 5618,5616,6134,5619

=====

PRECAUTIONARY LABELING

=====

BAKER SAF-T-DATA* SYSTEM

HEALTH	-	3	SEVERE (POISON)
FLAMMABILITY	-	0	NONE
REACTIVITY	-	2	MODERATE
CONTACT	-	3	SEVERE (CORROSIVE)

LABORATORY PROTECTIVE EQUIPMENT

GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

U.S. PRECAUTIONARY LABELING

POISON DANGER

CAUSES BURNS. MAY BE FATAL IF SWALLOWED OR INHALED.
DO NOT GET IN EYES, ON SKIN, ON CLOTHING. DO NOT BREATHE VAPOR. KEEP IN
TIGHTLY CLOSED CONTAINER. USE WITH ADEQUATE VENTILATION. WASH THOROUGHLY AFTER
HANDLING. IN CASE OF SPILL, NEUTRALIZE WITH SODA ASH OR LIME AND PLACE IN DRY
CONTAINER.

INTERNATIONAL LABELING

AVOID CONTACT WITH EYES. AFTER CONTACT WITH SKIN, WASH IMMEDIATELY WITH
PLENTY OF WATER. KEEP CONTAINER TIGHTLY CLOSED.

SAF-T-DATA* STORAGE COLOR CODE: WHITE (CORROSIVE)

CONTINUED ON PAGE: 2

ORIGINAL

J.T.BAKER INC. 222 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865

M A T E R I A L S A F E T Y D A T A S H E E T

24-HOUR EMERGENCY TELEPHONE -- (908) 859-2151

CHEMTREC # (800) 424-9300 -- NATIONAL RESPONSE CENTER # (800) 424-8802

H3686 -01

HYDROCHLORIC ACID, VOLUMETRIC SOLUTION

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SECTION II - COMPONENTS

COMPONENT	CAS NO.	WEIGHT %	OSHA/PEL	ACGIH/TLV
HYDROCHLORIC ACID	7647-01-0	5-25	5 PPM	5 PPM
WATER	7732-18-5	75-95	N/E	N/E

SECTION III - PHYSICAL DATA

BOILING POINT: N/A	VAPOR PRESSURE (MMHG): N/A
MELTING POINT: N/A	VAPOR DENSITY (AIR=1): N/A
SPECIFIC GRAVITY: N/A (H2O=1)	EVAPORATION RATE: N/A

SOLUBILITY(H2O): COMPLETE (100%)	% VOLATILES BY VOLUME: 100 (21 C)
----------------------------------	--------------------------------------

PH: 1.0 (0.1M SOLUTION)

ODOR THRESHOLD (P.P.M.): N/A

PHYSICAL STATE: LIQUID

COEFFICIENT WATER/OIL DISTRIBUTION: N/A

APPEARANCE & ODOR: CLEAR, COLORLESS LIQUID. HYDROCHLORIC ACID ODOR.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (CLOSED CUP): N/A

NEPA 704M RATING: 3-0-0

AUTOIGNITION TEMPERATURE: N/A

FLAMMABLE LIMITS: UPPER - N/A

LOWER - N/A

FIRE EXTINGUISHING MEDIA

USE EXTINGUISHING MEDIA APPROPRIATE FOR SURROUNDING FIRE.

SPECIAL FIRE-FIGHTING PROCEDURES

FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE. MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE

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ORIGINAL

J.T.BAKER INC. 222 RED SCHOOL LANE, PHILLIPSBURG, NJ 08365
MATERIAL SAFETY DATA SHEET
24-HOUR EMERGENCY TELEPHONE -- (908) 859-2151
CHEMTREC # (800) 424-9300 -- NATIONAL RESPONSE CENTER # (800) 424-8802

Hydro -01 HYDROCHLORIC ACID, VOLUMETRIC SOLUTION
EFFECTIVE: 03/09/92

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SECTION IV - FIRE AND EXPLOSION HAZARD DATA (CONTINUED)

=====

WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL.

UNUSUAL FIRE & EXPLOSION HAZARDS
REACTS WITH MOST METALS TO PRODUCE HYDROGEN GAS, WHICH CAN FORM AN
EXPLOSIVE MIXTURE WITH AIR.

TOXIC GASES PRODUCED
HYDROGEN CHLORIDE, HYDROGEN

EXPLOSION DATA-SENSITIVITY TO MECHANICAL IMPACT
NONE IDENTIFIED.

EXPLOSION DATA-SENSITIVITY TO STATIC DISCHARGE
NONE IDENTIFIED.

=====

SECTION V - HEALTH HAZARD DATA

=====

THRESHOLD LIMIT VALUE (TLV/TWA): 7 MG/M3 (5 PPM)

TLV LISTED DENOTES CEILING LIMIT.

SHORT-TERM EXPOSURE LIMIT (STEL): NOT ESTABLISHED

PERMISSIBLE EXPOSURE LIMIT (PEL): 7 MG/M3 (5 PPM)

PEL LISTED DENOTES CEILING LIMIT.

TOXICITY OF COMPONENTS

INTRAPERITONEAL MOUSE LD50 FOR HYDROCHLORIC ACID	40	MG/KG
ORAL RABBIT LD50 FOR HYDROCHLORIC ACID	900	MG/KG
INHALATION-1HR RAT LC50 FOR HYDROCHLORIC ACID	3124	PPM
INTRAPERITONEAL MOUSE LD50 FOR WATER	190	G/KG
INTRAVENOUS MOUSE LD50 FOR WATER	25	G/KG
CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO		

CARCINOGENICITY
NONE IDENTIFIED.

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ORIGINAL

J.T.BAKER INC. 222 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865

M A T E R I A L S A F E T Y D A T A S H E E T

24-HOUR EMERGENCY TELEPHONE -- (908) 859-2151

CHEMTREC # (800) 424-9300 -- NATIONAL RESPONSE CENTER # (800) 424-8802

H3886 -01

HYDROCHLORIC ACID, VOLUMETRIC SOLUTION

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EFFECTIVE: 03/09/72

ISSUED: 03/28/72

SECTION V - HEALTH HAZARD DATA (CONTINUED)

REPRODUCTIVE EFFECTS

NONE IDENTIFIED.

EFFECTS OF OVEREXPOSURE

INHALATION: PULMONARY EDEMA, CIRCULATORY FAILURE, RESPIRATORY SYSTEM DAMAGE, COLLAPSE, COUGHING, DIFFICULT BREATHING

SKIN CONTACT: BURNS

EYE CONTACT: BURNS

SKIN ABSORPTION: NONE IDENTIFIED

INGESTION: IS HARMFUL AND MAY BE FATAL, SEVERE BURNS TO MOUTH, THROAT, AND STOMACH, NAUSEA, VOMITING

CHRONIC EFFECTS: NONE IDENTIFIED

TARGET ORGANS

RESPIRATORY SYSTEM, EYES, SKIN

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

NONE IDENTIFIED

PRIMARY ROUTES OF ENTRY

INGESTION, INHALATION, SKIN CONTACT, EYE CONTACT

EMERGENCY AND FIRST AID PROCEDURES

INGESTION: CALL A PHYSICIAN. IF SWALLOWED, DO NOT INDUCE VOMITING. IF CONSCIOUS, GIVE WATER, MILK, OR MILK OF MAGNESIA.

INHALATION: IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.

SKIN CONTACT: IN CASE OF CONTACT, IMMEDIATELY FLUSH SKIN WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES. WASH CLOTHING BEFORE RE-USE.

CONTINUED ON PAGE: 5

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SECTION V - HEALTH HAZARD DATA (CONTINUED)

EYE CONTACT: IN CASE OF EYE CONTACT, IMMEDIATELY FLUSH WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES.

SARA/TITLE III HAZARD CATEGORIES AND LISTS

ACUTE: YES CHRONIC: YES FLAMMABILITY: NO PRESSURE: NO REACTIVITY: NO

EXTREMELY HAZARDOUS SUBSTANCE: YES CONTAINS HYDROGEN CHLORIDE (RQ = 1 LB, TPQ = 500 LBS)
CERCLA HAZARDOUS SUBSTANCE: YES CONTAINS HYDROCHLORIC ACID (RQ = 5000 LBS)
SARA 313 TOXIC CHEMICALS: YES CONTAINS HYDROCHLORIC ACID
GENERIC CLASS: C16
TSCA INVENTORY: YES

SECTION VI - REACTIVITY DATA

STABILITY: STABLE HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS TO AVOID: HEAT

INCOMPATIBLES: STRONG BASES, MOST COMMON METALS, AMINES, CARBONATES, SULFURIC ACID, CHLOROSULFONIC ACID, METAL OXIDES

DECOMPOSITION PRODUCTS: HYDROGEN CHLORIDE, HYDROGEN, CHLORINE

=====

SECTION VII - SPILL & DISPOSAL PROCEDURES

=====

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE.

WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING. STOP LEAK IF YOU CAN DO SO WITHOUT RISK. VENTILATE AREA. NEUTRALIZE SPILL WITH SODA ASH OR LIME. WITH CLEAN SHOVEL, CAREFULLY PLACE MATERIAL INTO CLEAN, DRY CONTAINER AND COVER; REMOVE FROM AREA. FLUSH SPILL AREA WITH WATER.

J. T. BAKER NEUTRASORB(R) OR TEAM(R) 'LOW NA+' ACID NEUTRALIZERS ARE
FOR SPILLS OF THIS PRODUCT.

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M A T E R I A L S A F E T Y D A T A S H E E T

CHEMTREC # (800) 424-9300 -- NATIONAL RESPONSE CENTER # (800) 424-8302

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DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL ENVIRONMENTAL REGULATIONS.

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

KEEP CONTAINER TIGHTLY CLOSED. STORE IN CORROSION-PROOF AREA. ISOLATE FROM INCOMPATIBLE MATERIALS.

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ORIGINAL

J.T.BAKER, INC. 222 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865

M A T E R I A L S A F E T Y D A T A S H E E T

24-HOUR EMERGENCY TELEPHONE -- (908) 959-2151

CHEMTREC # (800) 424-9300 -- NATIONAL RESPONSE CENTER # (800) 424-8802

H5086 -01

HYDROCHLORIC ACID, VOLUMETRIC SOLUTION

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SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION (CONTINUED)

AIR (I.C.A.O.)

PROPER SHIPPING NAME: HYDROCHLORIC ACID, SOLUTION

HAZARD CLASS:

8

UN: UN1789

PACKAGING GROUP: II

LABELS: CORROSIVE

REGULATORY REFERENCES: 49CFR 172.101; 173.6; PART 175; ICAO/IATA== WE BELIEVE THE TRANSPORTATION DATA AND REFERENCES CONTAINED HEREIN TO BE FACTUAL AND THE OPINION OF QUALIFIED EXPERTS. THE DATA IS MEANT AS A GUIDE TO THE OVERALL CLASSIFICATION OF THE PRODUCT AND IS NOT PACKAGE SIZE SPECIFIC, NOR SHOULD IT BE TAKEN AS A WARRANTY OR REPRESENTATION FOR WHICH THE COMPANY ASSUMES LEGAL RESPONSIBILITY.== THE INFORMATION IS OFFERED SOLELY FOR YOUR CONSIDERATION, INVESTIGATION, AND VERIFICATION. ANY USE OF THE INFORMATION MUST BE DETERMINED BY THE USER TO BE IN ACCORDANCE WITH APPLICABLE FEDERAL, STATE, AND LOCAL LAWS AND REGULATIONS. SEE SHIPPER REQUIREMENTS 49CFR 172.3 AND EMPLOYEE TRAINING 49CFR 173.1.

U.S. CUSTOMS HARMONIZATION NUMBER: 2806100000

N/A = NOT APPLICABLE OR NOT AVAILABLE

N/E = NOT ESTABLISHED

THE INFORMATION IN THIS MATERIAL SAFETY DATA SHEET MEETS THE REQUIREMENTS OF THE UNITED STATES OCCUPATIONAL SAFETY AND HEALTH ACT AND REGULATIONS PROMULGATED THEREUNDER (29 CFR 1910.1200 ET. SEQ.) AND THE CANADIAN WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM. THIS DOCUMENT IS INTENDED ONLY AS A GUIDE TO THE APPROPRIATE PRECAUTIONARY HANDLING OF THE MATERIAL BY A PERSON TRAINED IN, OR SUPERVISED BY A PERSON TRAINED IN, CHEMICAL HANDLING. THE USER IS RESPONSIBLE FOR DETERMINING THE PRECAUTIONS AND DANGERS OF THIS CHEMICAL FOR HIS OR HER PARTICULAR APPLICATION. DEPENDING ON USAGE, PROTECTIVE CLOTHING INCLUDING EYE AND FACE GUARDS AND RESPIRATORS MUST BE USED TO AVOID CONTACT WITH MATERIAL OR BREATHING CHEMICAL VAPORS/FUMES.

EXPOSURE TO THIS PRODUCT MAY HAVE SERIOUS ADVERSE HEALTH EFFECTS. THIS CHEMICAL MAY INTERACT WITH OTHER SUBSTANCES. SINCE THE POTENTIAL USES ARE SO VARIED, BAKER CANNOT WARN OF ALL OF THE POTENTIAL DANGERS OF USE OR INTERACTION WITH OTHER CHEMICALS OR MATERIALS. BAKER WARRANTS THAT THE CHEMICAL MEETS THE SPECIFICATIONS SET FORTH ON THE LABEL.

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ORIGINAL

J.T.BAKER INC. 222 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865
M A T E R I A L S A F E T Y D A T A S H E E T
24-HOUR EMERGENCY TELEPHONE -- (908) 859-2151
CHEMTREC # (800) 424-9300 -- NATIONAL RESPONSE CENTER # (900) 424-8802

H3886 -01 HYDROCHLORIC ACID, VOLUMETRIC SOLUTION
EFFECTIVE: 03/09/92

PAGE: 1
ISSUED: 03/28/92

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BAKER DISCLAIMS ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED WITH REGARD TO THE PRODUCT SUPPLIED HEREUNDER, ITS MERCHANTABILITY OR ITS FITNESS FOR A PARTICULAR PURPOSE.

THE USER SHOULD RECOGNIZE THAT THIS PRODUCT CAN CAUSE SEVERE INJURY AND EVEN DEATH, ESPECIALLY IF IMPROPERLY HANDLED OR THE KNOWN DANGERS OF USE ARE NOT HEEDED. READ ALL PRECAUTIONARY INFORMATION. AS NEW DOCUMENTED GENERAL SAFETY INFORMATION BECOMES AVAILABLE, BAKER WILL PERIODICALLY REVISE THIS MATERIAL SAFETY DATA SHEET.

NOTE: CHEMTREC, CANUTEC, AND NATIONAL RESPONSE CENTER EMERGENCY TELEPHONE NUMBERS ARE TO BE USED ONLY IN THE EVENT OF CHEMICAL EMERGENCIES INVOLVING A SPILL, LEAK, FIRE, EXPOSURE, OR ACCIDENT INVOLVING CHEMICALS. ALL NON-EMERGENCY QUESTIONS SHOULD BE DIRECTED TO CUSTOMER SERVICE (1-800-JTBAKER) FOR ASSISTANCE.

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APPROVED BY QUALITY ASSURANCE DEPARTMENT.

-- LAST PAGE --
"ISSUED BY VWR 07/10/93"

ORIGINAL

S4037 -09
EFFECTIVE: 07/29/96

SODIUM HYDROXIDE, 50% SOLUTION

PAGE: 1
ISSUED: 09/30/96

ALLINCKRODT BAKER, INC., 222 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865

SECTION I - PRODUCT IDENTIFICATION

PRODUCT NAME: SODIUM HYDROXIDE, 50% SOLUTION
COMMON SYNONYMS: CAUSTIC SODA; SODIUM HYDRATE; LYE
CHEMICAL FAMILY: AQUEOUS SOLUTIONS
FORMULA: NaOH IN H2O
FORMULA WT.: 40.00
CAS NO.: 1310-73-2
NIOSH/RTECS NO.: WB4900000
PRODUCT USE: LABORATORY REAGENT
PRODUCT CODES: 3735, 3727, 3725

PRECAUTIONARY LABELING

BAKER SAF-T-DATA* SYSTEM

HEALTH	-	3	SEVERE (POISON)
FLAMMABILITY	-	0	NONE
REACTIVITY	-	2	MODERATE
CONTACT	-	4	EXTREME (CORROSIVE)

LABORATORY PROTECTIVE EQUIPMENT

GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

U.S. PRECAUTIONARY LABELING

POISON DANGER

HARMFUL IF INHALED. CAUSES SEVERE BURNS. MAY BE FATAL IF SWALLOWED. REACTS VIOLENTLY WITH ACIDS. IMPORTANT: STORE ABOVE 60 F (16 C) TO PREVENT FREEZING. DO NOT GET IN EYES, ON SKIN, ON CLOTHING. AVOID BREATHING VAPOR. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING. IN CASE OF SPILL, CAREFULLY NEUTRALIZE SPILL WITH DILUTE HCL. FLUSH SPILL AREA WITH WATER.

INTERNATIONAL LABELING

CAUSES SEVERE BURNS.
KEEP OUT OF REACH OF CHILDREN. IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF WATER AND SEEK MEDICAL ADVICE. TAKE OFF IMMEDIATELY ALL CONTAMINATED CLOTHING. WEAR SUITABLE GLOVES AND EYE/FACE PROTECTION.

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ORIGINAL

J.T.BAKER INC. 222 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865
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CHEMTREC # (800) 424-9300 -- NATIONAL RESPONSE CENTER # (800) 424-8802

S4037 -09
EFFECTIVE: 07/29/96

SODIUM HYDROXIDE, 50% SOLUTION

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PRECAUTIONARY LABELING (CONTINUED)

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SAF-T-DATA* STORAGE COLOR CODE: WHITE STRIPE (STORE SEPARATELY)

=====

SECTION II - COMPONENTS

=====

COMPONENT	CAS NO.	WEIGHT %	OSHA/PEL	ACGIH/TLV
SODIUM HYDROXIDE	1310-73-2	50	2 MG/M3	2 MG/M3
WATER	7732-18-5	50	N/E	N/E

THE TLV AND PEL LISTED FOR SODIUM HYDROXIDE DENOTE CEILING LIMITS.

=====

SECTION III - PHYSICAL DATA

=====

BOILING POINT: 142 C (287 F)
(AT 760 MM HG)

VAPOR PRESSURE (MMHG): 1
(20 C)

MELTING POINT: 12 C (53 F)
(AT 760 MM HG)

VAPOR DENSITY (AIR=1): N/A

SPECIFIC GRAVITY: 1.53
(H2O=1)

EVAPORATION RATE: N/A

SOLUBILITY(H2O): COMPLETE (100%)

% VOLATILES BY VOLUME: 50
(21 C)

PH: 14.0 (1.0M SOLUTION)

ODOR THRESHOLD (P.P.M.): N/A

PHYSICAL STATE: LIQUID

COEFFICIENT WATER/OIL DISTRIBUTION: N/A

APPEARANCE & ODOR: CLEAR, COLORLESS VISCOUS LIQUID. ODORLESS.

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ORIGINAL

S4037 -09 SODIUM HYDROXIDE, 50% SOLUTION -
EFFECTIVE: 07/29/96

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SECTION IV - FIRE AND EXPLOSION HAZARD DATA

=====

FLASH POINT (CLOSED CUP): N/A NFPA 704M RATING: 3-0-1

AUTOIGNITION TEMPERATURE: N/A

FLAMMABLE LIMITS: UPPER - N/A LOWER - N/A

FIRE EXTINGUISHING MEDIA

USE EXTINGUISHING MEDIA APPROPRIATE FOR SURROUNDING FIRE.

SPECIAL FIRE-FIGHTING PROCEDURES

FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE. FLOOD WITH WATER SPRAY TO PREVENT SPLASHING OF MATERIAL.

UNUSUAL FIRE & EXPLOSION HAZARDS

REACTS WITH MOST METALS TO PRODUCE HYDROGEN GAS, WHICH CAN FORM AN EXPLOSIVE MIXTURE WITH AIR.

TOXIC GASES PRODUCED
HYDROGEN

EXPLOSION DATA-SENSITIVITY TO MECHANICAL IMPACT
NONE IDENTIFIED.

EXPLOSION DATA-SENSITIVITY TO STATIC DISCHARGE
NONE IDENTIFIED.

=====

SECTION V - HEALTH HAZARD DATA

=====

THRESHOLD LIMIT VALUE (TLV/TWA): 2 MG/M3

TLV (CEILING) IS FOR SODIUM HYDROXIDE.

SHORT-TERM EXPOSURE LIMIT (STEL): NOT ESTABLISHED

PERMISSIBLE EXPOSURE LIMIT (PEL): 2 MG/M3

PEL (CEILING) IS FOR SODIUM HYDROXIDE.

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S4037 -09
EFFECTIVE: 07/29/96

SODIUM HYDROXIDE, 50% SOLUTION

PAGE: 4
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SECTION V - HEALTH HAZARD DATA (CONTINUED)

=====

TOXICITY OF COMPONENTS

INTRAPERITONEAL MOUSE LD50 FOR SODIUM HYDROXIDE	40	MG/KG
INTRAPERITONEAL MOUSE LD50 FOR WATER	190	G/KG
INTRAVENOUS MOUSE LD50 FOR WATER	25	G/KG

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

CARCINOGENICITY
NONE IDENTIFIED.

REPRODUCTIVE EFFECTS
NONE IDENTIFIED.

EFFECTS OF OVEREXPOSURE

INHALATION: SEVERE IRRITATION OR BURNS OF RESPIRATORY SYSTEM,
PULMONARY EDEMA, LUNG INFLAMMATION, MAY CAUSE RESPIRATORY
SYSTEM DAMAGE

SKIN CONTACT: BURNS

EYE CONTACT: BURNS, PERMANENT EYE DAMAGE

SKIN ABSORPTION: NONE IDENTIFIED

INGESTION: IS HARMFUL AND MAY BE FATAL. SEVERE BURNS TO MOUTH,
THROAT, AND STOMACH, NAUSEA, VOMITING

CHRONIC EFFECTS: NONE IDENTIFIED

TARGET ORGANS
EYES, SKIN, RESPIRATORY SYSTEM, LUNGS

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE
DAMAGED SKIN

PRIMARY ROUTES OF ENTRY
INHALATION, INGESTION, EYE CONTACT, SKIN CONTACT

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ORIGINAL

S4037 -09 SODIUM HYDROXIDE, 50% SOLUTION
EFFECTIVE: 07/29/96

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ISSUED: 09/30/96

SECTION V - HEALTH HAZARD DATA (CONTINUED)

EMERGENCY AND FIRST AID PROCEDURES

INGESTION: CALL A PHYSICIAN. IF SWALLOWED, DO NOT INDUCE VOMITING. IF CONSCIOUS, GIVE LARGE AMOUNTS OF WATER. FOLLOW WITH DILUTED VINEGAR, FRUIT JUICE OR WHITES OF EGGS BEATEN WITH WATER.

INHALATION: IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN. PROMPT ACTION IS ESSENTIAL.

SKIN CONTACT: IN CASE OF CONTACT, IMMEDIATELY FLUSH SKIN WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES. WASH CLOTHING BEFORE RE-USE.

EYE CONTACT: IN CASE OF EYE CONTACT, IMMEDIATELY FLUSH WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES.

NOTES TO PHYSICIAN

IN CASES OF SEVERE ESOPHAGEAL CORROSION, THE USE OF THERAPEUTIC DOSES OF STEROIDS SHOULD BE CONSIDERED. GENERAL SUPPORTIVE MEASURES WITH CONTINUAL MONITORING OF GAS EXCHANGE, ACID-BASE BALANCE, ELECTROLYTES, AND FLUID INTAKE ARE ALSO REQUIRED.

SARA/TITLE III HAZARD CATEGORIES AND LISTS

ACUTE: YES CHRONIC: YES FLAMMABILITY: NO PRESSURE: NO REACTIVITY: NO

EXTREMELY HAZARDOUS SUBSTANCE: NO

CERCLA HAZARDOUS SUBSTANCE: YES

SARA 313 TOXIC CHEMICALS: NO

GENERIC CLASS:

CONTAINS SODIUM HYDROXIDE (RQ = 1000 LBS)

GENERIC CLASS REMOVED FROM CFR: 7/1/91

TSCA INVENTORY:

YES

SECTION VI - REACTIVITY DATA

STABILITY: STABLE

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS TO AVOID: HEAT

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ORIGINAL

J.T. BAKER INC. 222 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865
M A T E R I A L S A F E T Y D A T A S H E E T
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S4037 -09
EFFECTIVE: 07/29/96

SODIUM HYDROXIDE, 50% SOLUTION

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SECTION VI - REACTIVITY DATA (CONTINUED)

=====

INCOMPATIBLES: STRONG ACIDS, MOST COMMON METALS, COMBUSTIBLE
 MATERIALS, ORGANIC MATERIALS, ZINC, ALUMINUM,
 PEROXIDES, HALOGENATED HYDROCARBONS

DECOMPOSITION PRODUCTS: HYDROGEN

=====

SECTION VII - SPILL & DISPOSAL PROCEDURES

=====

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE
WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING.
STOP LEAK IF YOU CAN DO SO WITHOUT RISK. VENTILATE AREA. CAREFULLY
NEUTRALIZE SPILL WITH DILUTE HCL. FLUSH AREA WITH FLOODING AMOUNTS OF
WATER. (USE CAUTION.)

J. T. BAKER NEUTRACIT(R)-2 OR BUCAIM(R) CAUSTIC NEUTRALIZERS ARE RECOMMENDED
SPILLS OF THIS PRODUCT.

DISPOSAL PROCEDURE
DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL
ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER: D002, D003 (CORROSIVE, REACTIVE WASTE)

=====

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

=====

VENTILATION: USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV
 REQUIREMENTS.

RESPIRATORY PROTECTION: RESPIRATORY PROTECTION REQUIRED IF AIRBORNE
 CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS UP TO
 100 PPM, A HIGH-EFFICIENCY PARTICULATE RESPIRATOR IS
 RECOMMENDED. ABOVE THIS LEVEL, A SELF-CONTAINED
 BREATHING APPARATUS IS ADVISED.

EYE/SKIN PROTECTION: SAFETY GOGGLES AND FACE SHIELD, UNIFORM, PROTECTIVE
 SUIT, NEOPRENE GLOVES ARE RECOMMENDED.

CONTINUED ON PAGE: 7

S4037 -09 SODIUM HYDROXIDE, 50% SOLUTION
EFFECTIVE: 07/29/96

PAGE: 7
ISSUED: 09/30/96

=====

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

=====

SAF-T-DATA* STORAGE COLOR CODE: WHITE STRIPE (STORE SEPARATELY)

STORAGE REQUIREMENTS

KEEP CONTAINER TIGHTLY CLOSED. STORE IN CORROSION-PROOF AREA. ISOLATE
FROM INCOMPATIBLE MATERIALS. IMPORTANT: STORE ABOVE 60 F (16 C) TO
PREVENT FREEZING.

=====

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

=====

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME: SODIUM HYDROXIDE, SOLUTION
HAZARD CLASS: 8
UN/NA: UN1824 REPORTABLE QUANTITY: 1000 LBS. PACKAGING GROUP: II
LABELS: 8 CORROSIVE
REGULATORY REFERENCES: 49CFR 172.101

INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME: SODIUM HYDROXIDE, SOLUTION
HAZARD CLASS: 8
UN: UN1824 MARINE POLLUTANTS: NO
LABELS: 8 CORROSIVE
REGULATORY REFERENCES: 49CFR PART 176; IMDG CODE

I.M.O. PAGE: 8226
PACKAGING GROUP: II

AIR (I.C.A.O.)

PROPER SHIPPING NAME: SODIUM HYDROXIDE, SOLUTION
HAZARD CLASS: 8
UN: UN1824
LABELS: 8 CORROSIVE
REGULATORY REFERENCES: 49CFR PART 175; ICAO==

PACKAGING GROUP: II

WE BELIEVE THE TRANSPORTATION
DATA AND REFERENCES CONTAINED HEREIN TO BE FACTUAL AND
THE OPINION OF QUALIFIED EXPERTS. THE DATA IS MEANT AS
A GUIDE TO THE OVERALL CLASSIFICATION OF THE PRODUCT
AND IS NOT PACKAGE SIZE SPECIFIC, NOR SHOULD IT BE
TAKEN AS A WARRANTY OR REPRESENTATION FOR WHICH THE
COMPANY ASSUMES LEGAL RESPONSIBILITY.== THE
INFORMATION IS OFFERED SOLELY FOR YOUR CONSIDERATION,
INVESTIGATION, AND VERIFICATION. ANY USE OF THE
INFORMATION MUST BE DETERMINED BY THE USER TO BE IN
ACCORDANCE WITH APPLICABLE FEDERAL, STATE, AND LOCAL
LAWS AND REGULATIONS. SEE SHIPPER REQUIREMENTS 49CFR
CONTINUED ON PAGE: 8

ORIGINAL

S4037 -09
EFFECTIVE: 07/29/96

SODIUM HYDROXIDE, 50% SOLUTION

PAGE: 8
ISSUED: 09/30/96

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SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION (CONTINUED)

=====

171.2, CERTIFICATION 172.204, AND EMPLOYEE TRAINING 49
CFR 173.1(B).

U.S. CUSTOMS HARMONIZATION NUMBER: 28151200007

=====

NOTE: WHEN HANDLING LIQUID PRODUCTS, SECONDARY PROTECTIVE CONTAINERS MUST BE USED FOR CARRYING.

-N/A = NOT APPLICABLE, OR NOT AVAILABLE; -N/E = NOT ESTABLISHED

=====

MALLINCKRODT BAKER PROVIDES THE INFORMATION CONTAINED HEREIN IN GOOD FAITH BUT MAKES NO REPRESENTATION AS TO ITS COMPREHENSIVENESS OR ACCURACY. THIS DOCUMENT IS INTENDED ONLY AS A GUIDE TO THE APPROPRIATE PRECAUTIONARY HANDLING OF THE MATERIAL BY A PROPERLY TRAINED PERSON USING THIS PRODUCT. INDIVIDUALS RECEIVING THE INFORMATION MUST EXERCISE THEIR INDEPENDENT JUDGMENT IN DETERMINING ITS APPROPRIATENESS FOR A PARTICULAR PURPOSE. MALLINCKRODT BAKER MAKES NO REPRESENTATIONS, OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

=====

NOTE: CHEMTREC, CANUTEC AND NATIONAL RESPONSE CENTER EMERGENCY TELEPHONE NUMBERS ARE TO BE USED ONLY IN THE EVENT OF CHEMICAL EMERGENCIES INVOLVING A SPILL, LEAK, FIRE, EXPOSURE, OR ACCIDENT INVOLVING CHEMICALS. ALL NON-EMERGENCY QUESTIONS SHOULD BE DIRECTED TO CUSTOMER SERVICE (1-800-JTBAKER) FOR ASSISTANCE.

=====

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*TRADEMARKS OF MALLINCKRODT BAKER, INC.
APPROVED BY QUALITY ASSURANCE DEPARTMENT.

-- LAST PAGE --
"ISSUED BY VWR 01/28/98"

J.T. BAKER INC. 222 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865
M A T E R I A L S A F E T Y D A T A S H E E T
24-HOUR EMERGENCY TELEPHONE -- (908) 859-2151
CHEMTREC # (800) 424-9300 -- NATIONAL RESPONSE CENTER # (800) 424-8802

S4037 -09
EFFECTIVE: 07/29/96

SODIUM HYDROXIDE, 50% SOLUTION

PAGE: 7
ISSUED: 09/30/96

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SECTION IX - STORAGE AND HANDLING PRECAUTIONS

=====

SAF-T-DATA* STORAGE COLOR CODE: WHITE STRIPE (STORE SEPARATELY)

STORAGE REQUIREMENTS

KEEP CONTAINER TIGHTLY CLOSED. STORE IN CORROSION-PROOF AREA. ISOLATE FROM INCOMPATIBLE MATERIALS. IMPORTANT: STORE ABOVE 60 F (16 C) TO PREVENT FREEZING.

=====

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

=====

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME: SODIUM HYDROXIDE, SOLUTION
HAZARD CLASS: 8
UN/NA: UN1824 REPORTABLE QUANTITY: 1000 LBS. PACKAGING GROUP: II
LABELS: 8 CORROSIVE
REGULATORY REFERENCES: 49CFR 172.101

INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME: SODIUM HYDROXIDE, SOLUTION
HAZARD CLASS: 8
UN: UN1824 MARINE POLLUTANTS: NO
LABELS: 8 CORROSIVE
REGULATORY REFERENCES: 49CFR PART 176; IMDG CODE

I.M.O. PAGE: 8226
PACKAGING GROUP: II

AIR (I.C.A.O.)

PROPER SHIPPING NAME: SODIUM HYDROXIDE, SOLUTION
HAZARD CLASS: 8
UN: UN1824
LABELS: 8 CORROSIVE
REGULATORY REFERENCES: 49CFR PART 175; ICAO=== WE BELIEVE THE TRANSPORTATION

PACKAGING GROUP: II

DATA AND REFERENCES CONTAINED HEREIN TO BE FACTUAL AND THE OPINION OF QUALIFIED EXPERTS. THE DATA IS MEANT AS A GUIDE TO THE OVERALL CLASSIFICATION OF THE PRODUCT AND IS NOT PACKAGE SIZE SPECIFIC, NOR SHOULD IT BE TAKEN AS A WARRANTY OR REPRESENTATION FOR WHICH THE COMPANY ASSUMES LEGAL RESPONSIBILITY.=== THE INFORMATION IS OFFERED SOLELY FOR YOUR CONSIDERATION, INVESTIGATION, AND VERIFICATION. ANY USE OF THE INFORMATION MUST BE DETERMINED BY THE USER TO BE IN ACCORDANCE WITH APPLICABLE FEDERAL, STATE, AND LOCAL LAWS AND REGULATIONS. SEE SHIPPER REQUIREMENTS 49CFR

CONTINUED ON PAGE: 8

Air Material Safety Data Sheet

Industrial Gas Division
Air Products and Chemicals, Inc.
Allentown, PA 18195
Tel. (215) 481-4911 · TWX 510-651-3686
Cable-AIRPROD · Telex 847416
Fax (215) 481-5900

ORIGINAL
**AIR
PRODUCTS**

EMERGENCY PHONE: 800—523-9374		IN PENNSYLVANIA: 800—322-9092	
ISSUE DATE	Issued: 15 March 1978	TRADE NAME AND SYNONYMS Air; Compressed Air; Compressed Air, Breathing Quality	CHEMICAL NAME AND SYNONYMS Air
REVISIONS	Rev: 1 June 1990	FORMULA Reconstituted air—approx. 79% N ₂ , 21% O ₂ Compressed—78% N ₂ , 21% O ₂ , Balance: Other atmospheric gases	CHEMICAL FAMILY N/A (Air does not have a CAS#)

HEALTH HAZARD DATA

EXPOSURE LIMITS

Air is nontoxic and no exposure limits have been established. Air is not listed as a carcinogen by NTP, IARC, or OSHA.

SYMPTOMS IF INGESTED, CONTACTED WITH SKIN, OR VAPOR INHALED

Air is nontoxic and is necessary to support life. Inhalation of air at high pressures, such as pressures which may exist in hyperbar chambers, can result in similar symptoms to those of exposure to oxygen. Inhalation of air at high pressures can also result in a cumulation of nitrogen in the blood which may result in decompression sickness.

TOXICOLOGICAL PROPERTIES

Exposure to high pressures of air where the partial pressure of oxygen is in excess of two atmospheres may produce a variety of central nervous system manifestations including tingling of fingers and toes, visual and acoustical disturbances, abnormal sensations, impaired coordination, confusion, muscle twitching, and epileptiform seizures. Severe hazards may be present when confusion and impaired judgment lead to operational errors. Exposure to high pressures may also result in nitrogen narcosis.

RECOMMENDED FIRST AID TREATMENT

Facilities at which air is breathed under pressure should be prepared to deal with illness related to a hyperbaric environment. Decompression equipment may be required.

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) N/A	AUTO IGNITION TEMP N/A	FLAMMABLE LIMITS N/A	LEL N/A	UEL N/A
EXTINGUISHING MEDIA N/A			ELECTRICAL CLASSIFICATION GROUP N/A	
SPECIAL FIRE FIGHTING PROCEDURES N/A				
UNUSUAL FIRE AND EXPLOSION HAZARDS Compressed air at high pressure can accelerate the burning of materials which are combustible at atmospheric pressure.				

PHYSICAL DATA

BOILING POINT (°F.) @ 1 atm -317.9F (-194.4C)		FREEZING POINT (°F) Range: -351F to -358F (-213C to -216C) (Because air is mixture)	
VAPOR PRESSURE (psia) N/A		SOLUBILITY IN WATER @ 68F (20C), 1 atm 1.87% by volume	
VAPOR DENSITY (lb/cu ft) @ 68F (20C), 1 atm 0.07520	SPECIFIC GRAVITY (AIR = 1) @ 68F (20C), 1 atm 1.00	LIQUID DENSITY (lb/cu ft) @ boiling point, 1 atm 54.56	SPECIFIC GRAVITY (H ₂ O = 1) @ boiling point, 1 atm 0.874
APPEARANCE AND ODOR Gaseous air is odorless and colorless.			

REACTIVITY DATA

STABLE	UNSTABLE	CONDITIONS TO AVOID
	STABLE	X Avoid the use of oil in systems at full cylinder pressure.

INCOMPATIBILITY (Materials to avoid)

None

HAZARDOUS DECOMPOSITION PRODUCTS

None

HAZARDOUS
POLYMERIZATION

MAY OCCUR

CONDITIONS TO AVOID

WILL NOT OCCUR

X

None

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

No hazard.

WASTE DISPOSAL METHOD

Do not attempt to dispose of residual air in compressed gas cylinders. Return to Air Products with the cylinder valve tightly closed, positive pressure in the cylinder, and valve cap in place.

SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)

None

VENTILATION

None

LOCAL EXHAUST

None

SPECIAL

None

MECHANICAL (General)

None

OTHER

None

PROTECTIVE GLOVES

Leather work gloves are recommended when handling compressed gas cylinders.

EYE PROTECTION

Safety glasses are recommended when handling high-pressure cylinders.

OTHER PROTECTIVE EQUIPMENT

Safety toe shoes are recommended when handling high-pressure cylinders.

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION

DOT Shipping Name: Air, Compressed. DOT Hazard Class: Nonflammable Gas. DOT Shipping Label: Nonflammable Gas. I.D. Number: UN 1002.

SPECIAL HANDLING RECOMMENDATIONS

Compressed gas cylinders contain gas with extremely high pressure and should be handled with care. Use a pressure-reducing regulator when connecting to lower pressure equipment and piping systems. Secure cylinders when in use. Never use direct flame to heat a compressed gas cylinder. Use a check valve to prevent backflow into storage container. Avoid dragging, rolling, or sliding cylinders, even for a short distance. Use a suitable hand truck. For additional handling recommendations on compressed gas cylinders, consult Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS

Keep cylinders away from source of heat. Storage should not be in heavy traffic areas to prevent accidental knocking over or damage from passing or falling objects. Valve caps should remain on cylinders not connected for use. Segregate full and empty cylinders. Storage areas should be free of combustible material. Avoid exposure to areas where salt or other corrosive chemicals are present. Store compressed gas cylinders with the valve end up. See Compressed Gas Association Pamphlet P-1 for additional storage recommendations.

SPECIAL PACKAGING RECOMMENDATIONS

Compressed air cylinders meet DOT specifications.

OTHER RECOMMENDATIONS OR PRECAUTIONS

Compressed gas cylinders should not be refilled except by qualified producers of a compressed gases. Shipment of a compressed gas cylinder filled without the permission of the owner is a violation of Federal Law.

*Various Government agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation handling, storage or use of this product which will not be reflected in this data sheet. The customer should review these regulations to ensure that s/he is in full compliance.

ORIGINAL

MATERIAL SAFETY DATA SHEET
 29 CFR 1910.1200 OSHA Hazard
 Communication Rule Format

MINE SAFETY APPLIANCES COMPANY
 P.O. Box 426
 Pittsburgh, PA 15230
 PHONE (412) 967-3000

This product contains pentane, oxygen and nitrogen, substances subject to the Pennsylvania Worker and Community Right-To-Know Act

PRODUCT IDENTITY

LABEL IDENTITY - MSA P/N 476304 Calibration Check Gas, 0.75% Pentane and 15% Oxygen in Nitrogen
 CHEMICAL NAME - Pentane, Oxygen, Nitrogen Mixture
 ADDITIONAL IDENTITIES - MSA P/N 476304 Calibration Gas
 FORMULA - C_5H_{12} in $O_2 + N_2$

APPLICABLE CHEMICAL CONTENTS

	<u>%</u>	<u>TWA</u>
Pentane (CAS 109-66-0)	0.75	0.06%
STEL 750 ppm (ACGIH 1995-96)		
Oxygen (CAS 7782-44-7)	15	None
Nitrogen (CAS 7727-37-9)	Balance	None

NOTE: Gas Under Pressure, 300 PSIG at 70°F, Approx. 19 Liters at Atmospheric Pressure

PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AND ODOR - Colorless Gas, Faint Hydrocarbon Odor
 BOILING POINT - N/A SPECIFIC GRAVITY ($H_2O = 1$) - N/A
 VAPOR PRESSURE - N/A PERCENT VOLATILE BY VOLUME - N/A
 VAPOR DENSITY (AIR = 1) - Approx. 1
 SOLUBILITY IN WATER - Pentane - 11 $cm^3/100$ ml (16°C)
 Oxygen - 3.2 $cm^3/100$ ml (25°C)
 Nitrogen - 2.3 $cm^3/100$ ml (0°C)

N/A - Not Applicable

PHYSICAL HAZARD INFORMATION

PHYSICAL HAZARD - Compressed Gas, 300 PSIG at 70°F
 CONDITIONS OR MATERIALS TO AVOID - None
 FLASH POINT - N/A LEL - N/A UEL - N/A
 EXTINGUISHING MEDIA - This Gas Mixture Is Not Flammable.
 SPECIAL FIRE FIGHTING PROCEDURES - See Next Item
 UNUSUAL FIRE AND EXPLOSION HAZARDS - Gas Under Pressure, 300 PSIG at 70°F. Do Not Exceed 120°F.

HEALTH HAZARDS

HEALTH HAZARDS - Pentane may be irritating to mucous membranes.

SIGNS AND SYMPTOMS OF EXPOSURE - Respiratory Tract Irritation

PRIMARY ROUTES OF ENTRY - Inhalation

TARGET ORGANS - Respiratory Tract

MEDICAL CONDITIONS GENERALLY RECOGNIZED AS BEING AGGRAVATED BY EXPOSURE - No Information

EXPOSURE LIMITS - ACGIH, Pentane 600 ppm, 750 ppm STEL (1995-96)

CARCINOGENICITY DATA - Component gases are not listed by NIOSH RTECS, OSHA, NTP or IARC.

EMERGENCY AND FIRST AID PROCEDURES - Remove from Exposure

SAFE HANDLING AND USE

HYGIENIC PRACTICES - Avoid Breathing Gas

PROTECTIVE MEASURES DURING REPAIR AND MAINTENANCE OF CONTAMINATED EQUIPMENT - N/A

PROCEDURES FOR SPILL OR LEAK CLEANUP - Ventilate Area. Avoid Breathing Gas.

WASTE DISPOSAL - Do not puncture or incinerate cylinder. Before discarding cylinder, slowly release contents to a safe exhaust.

STORAGE - Store in a cool, dry, well-ventilated area. Do not exceed 120°F.

CONTROL MEASURES

PERSONAL PROTECTIVE EQUIPMENT - Due to the limited amount of gas in the cylinder, and the low release rate employed in instrument calibration, respiratory protection is not indicated under conditions of intended use.

ENGINEERING CONTROLS - Mechanical ventilation is suitable.

WORK PRACTICES - Avoid breathing gas. Use in well-ventilated areas. Follow the calibration procedure detailed in the MSA instruction manual provided with the instrument under calibration.

DATE OF PREPARATION - Rev. 5, July 1996

The information provided herein has been compiled from sources believed to be reliable. However, Mine Safety Appliances Company makes no warranty as to the accuracy, completeness, or sufficiency of the information and in no event will Mine Safety Appliances Company be responsible for loss or damage of any nature whatsoever resulting from use of the information.

MATERIAL SAFETY DATA SHEET
29 CFR 1910.1200 OSHA Hazard
Communication Rule Format

MINE SAFETY APPLIANCES COMPANY
P.O. Box 426
Pittsburgh, PA 15230
PHONE (412) 967-3000

ORIGINAL

This product contains carbon monoxide, methane, oxygen and nitrogen, substances subject to the Pennsylvania Worker and Community Right-To-Know Act.

PRODUCT IDENTITY

LABEL IDENTITY - MSA P/N 478191 Calibration Check Gas, 60 ppm Carbon Monoxide, 1.45% Methane, 15% Oxygen, Balance Nitrogen

CHEMICAL NAME - Carbon Monoxide, Methane, Oxygen, Nitrogen Mixture

ADDITIONAL IDENTITIES - MSA P/N 478191 Calibration Gas

FORMULA - $\text{CO} + \text{CH}_4 + \text{O}_2 + \text{N}_2$

APPLICABLE CHEMICAL CONTENTS

	<u>%</u>	<u>TWA</u>
Carbon Monoxide (CAS 630-08-0, ACGIH 1995-96)	0.0060	25 ppm
Methane (CAS 74-82-8)	1.45	None*
Oxygen (CAS 7782-44-7)	15	None
Nitrogen (CAS 7727-37-9)	Balance	None

*Methane is a simple asphyxiant (ACGIH 1995-96)

NOTE: Gas Under Pressure, 1000 PSIG at 70°F, Approx. 100 Liters Gas at Atmospheric Pressure

PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AND ODOR - Colorless, Odorless Gas

BOILING POINT - N/A** **SPECIFIC GRAVITY (H₂O = 1) -** N/A

VAPOR PRESSURE - N/A **PERCENT VOLATILE BY VOLUME -** N/A

VAPOR DENSITY (AIR = 1) - Approx. 1

SOLUBILITY IN WATER -

Carbon Monoxide -	3.5 cm ³ /100 ml (0°C)
Methane -	9 cm ³ /100 ml (20°C)
Oxygen -	3.2 cm ³ /100 ml (25°C)
Nitrogen -	2.3 cm ³ /100 ml (0°C)

**N/A - Not Applicable

PHYSICAL HAZARD INFORMATION

PHYSICAL HAZARD - Compressed Gas, 1000 PSIG at 70°F

CONDITIONS OR MATERIALS TO AVOID - None

FLASH POINT - N/A

LEL - N/A

UEL - N/A

EXTINGUISHING MEDIA - This Gas Mixture is not Flammable

SPECIAL FIRE FIGHTING PROCEDURES - See Next Item

UNUSUAL FIRE AND EXPLOSION HAZARDS - Gas Under Pressure, 1000 PSIG at 70°F. Do Not Exceed 120°F.

ORIGINAL

HEALTH HAZARDS

HEALTH HAZARDS - Methane is a simple asphyxiant (ACGIH 1995-96). Carbon monoxide TCLO (Human) is reportedly 650 ppm/45 minutes; LCLO (Human) 5000 ppm/5 minutes.

SIGNS AND SYMPTOMS OF EXPOSURE - None known for 1.45% methane. Exposure to 500-1000 ppm CO may cause headache, rapid breathing, nausea, weakness, dizziness and confusion.

PRIMARY ROUTES OF ENTRY - Inhalation

TARGET ORGANS - CO: Lungs, Blood, Tissues. CO at toxic concentrations causes tissue hypoxia (lack of oxygen) by preventing blood from transporting sufficient oxygen.

MEDICAL CONDITIONS GENERALLY RECOGNIZED AS BEING AGGRAVATED BY EXPOSURE - Carbon monoxide burden may aggravate anagina pectoris. Pregnant women are reportedly more sensitive than others. Effects of CO exposure are aggravated by heavy labor, heat stress and high altitude.

EXPOSURE LIMITS - Carbon Monoxide 25 ppm (ACGIH 1995-96). OSHA CO TWA=35 ppm.

CARCINOGENICITY DATA - Component gases are not listed by NIOSH RTECS, OSHA, NTP or IARC.

EMERGENCY AND FIRST AID PROCEDURES - Remove From Exposure. Administer Oxygen. Consult Physician Immediately.

SAFE HANDLING AND USE

HYGIENIC PRACTICES - Avoid Breathing Gas

PROTECTIVE MEASURES DURING REPAIR AND MAINTENANCE OF CONTAMINATED EQUIPMENT - N/A

PROCEDURES FOR SPILL OR LEAK CLEANUP - Ventilate Area. Avoid Breathing Gas.

WASTE DISPOSAL - Do not puncture or incinerate cylinder. Before discarding cylinder, slowly release contents to a safe exhaust.

STORAGE - Store in a cool, dry, well-ventilated area. Do not exceed 120°F.

CONTROL MEASURES

PERSONAL PROTECTIVE EQUIPMENT - Due to the limited amount of gas in the cylinder, and the low release rate employed in instrument calibration, respiratory protection is not indicated under conditions of intended use.

ENGINEERING CONTROLS - Mechanical ventilation is suitable.

WORK PRACTICES - Avoid breathing gas. Use in well-ventilated areas. Follow the calibration procedure detailed in the MSA instruction manual provided with the instrument under calibration.

DATE OF PREPARATION - Rev. 5, July 1996

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Material Safety Data Sheet

LIQUID AIR CORPORATION ALPHAGAZ DIVISION One California Plaza, Suite 350 2121 N. California Blvd. Walnut Creek, California 94596	PRODUCT NAME Hydrogen Sulfide	CAS NUMBER 7783-06-04
	TELEPHONE (415) 977-6500 EMERGENCY RESPONSE INFORMATION ON PAGE 2	
ISSUE DATE OCTOBER 1, 1985 AND REVISIONS CORPORATE SAFETY DEPT.	TRADE NAME AND SYNONYMS Hydrogen Sulfide	CHEMICAL FAMILY Nonmetal hydride
	CHEMICAL NAME AND SYNONYMS Hydrogen Sulfide	
	FORMULA H ₂ S	MOLECULAR WEIGHT 34.06

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT

10 molar PPM; STEL = 15 molar PPM (ACGIH, 1984-85)

SYMPTOMS OF EXPOSURE

Continuous exposure to low (15-50 PPM) concentrations will generally cause irritation to mucous membranes and conjunctivae of the eyes. It may also cause headache, dizziness or nausea. Higher concentrations (200-300 PPM) can result in respiratory arrest leading to coma or unconsciousness. Exposures for more than 30 minutes at concentrations of greater than 700 PPM have been fatal. Continuous inhalation of low concentrations may cause olfactory fatigue or paralysis rendering the detection of its presence by odor ineffective.

TOXICOLOGICAL PROPERTIES

Inhalation of hydrogen sulfide is highly toxic. It is also an irritant to mucous tissue, membranes and the conjunctivae of the eyes. Continued exposure renders the olfactory sensors inoperative. Toxicologically its reaction with enzymes in the blood stream inhibit cell respiration resulting in pulmonary paralysis, sudden collapse and death. This overshadows its irritant effect on mucous membranes and tissues which at worst will cause pulmonary edema or conjunctival lesions.

Listed as Carcinogen
or Potential Carcinogen

National Toxicology
Program

Yes ☐
No ☒

I.A.R.C.
Monographs

Yes ☐
No ☒

OSHA Yes ☐
No ☒

RECOMMENDED FIRST AID TREATMENT

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO HYDROGEN SULFIDE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. RESCUE PERSONNEL SHOULD RECOGNIZE THE HAZARDS OF OVEREXPOSURE DUE TO OLFACTORY FATIGUE.

Inhalation: Extreme fire hazard when rescuing semi-conscious or unconscious persons due to flammability of hydrogen sulfide. Avoid use of rescue equipment which might contain ignition sources or cause static discharge. Move affected person to an uncontaminated area. If breathing has stopped, give assisted respiration. Oxygen or a mixture of 5% carbon dioxide in oxygen should be administered by a qualified person. Keep victim warm and calm. Seek immediate medical assistance. (Continued on last page.)

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

Hydrogen sulfide will explode or burn over a wide range of mixtures in air. It becomes dangerously reactive when mixed with concentrated nitric acid or other strong oxidizers such as sulfuric acid. Vapors will combust spontaneously when mixed with vapors of chlorine, oxygen difluoride or nitrogen trifluoride.

PHYSICAL DATA

BOILING POINT -76.4°F (-60.2°C)	LIQUID DENSITY AT BOILING POINT 57.11 lb/ft ³ (914.9 kg/m ³)
VAPOR PRESSURE 266.9 psia (1840 kPa)	GAS DENSITY AT 70°F 1 atm .091 lbs/ft ³ (1.45 kg/m ³)
SOLUBILITY IN WATER Soluble	FREEZING POINT -122.3°F (-85.7°C)
APPEARANCE AND ODOR Shipped and stored as a liquid under its own vapor pressure. Vapor is colorless with a characteristic "rotten egg" odor. Specific gravity (Air=1.0) is 1.21	

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED) Gas	AUTO IGNITION TEMPERATURE 554°F (290°C)	FLAMMABLE LIMITS % BY VOLUME LEL: 4.0 UEL: 44.0
EXTINGUISHING MEDIA Carbon dioxide, dry chemical or water spray		ELECTRICAL CLASSIFICATION NEC Class I
SPECIAL FIRE FIGHTING PROCEDURES Shut off flow of gas. Cool surrounding fire-exposed containers with water spray. Fire fighters should use self-contained breathing apparatus.		
UNUSUAL FIRE AND EXPLOSION HAZARDS Hydrogen sulfide is slightly heavier than air so may accumulate in low spots and may "travel" a considerable distance to a flame or other source of ignition.		

REACTIVITY DATA

STABILITY Unstable		CONDITIONS TO AVOID
Stable	X	Avoid heat, flame or other sources of ignition.
INCOMPATIBILITY (Materials to avoid) Concentrated nitric acid, chlorine, nitrogen trifluoride, oxygen difluoride or other strong oxidizing agents.		
HAZARDOUS DECOMPOSITION PRODUCTS Oxides of sulfur		
HAZARDOUS POLYMERIZATION May Occur		CONDITIONS TO AVOID
Will Not Occur	X	

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is in container or container valve, contact the closest Liquid Air Corporation location.

WASTE DISPOSAL METHOD

Do not attempt to dispose of waste or unused quantities. Return in the shipping container properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place to Liquid Air Corporation for proper disposal. For emergency disposal, contact the closest Liquid Air Corporation location.

EMERGENCY RESPONSE INFORMATION

IN CASE OF EMERGENCY INVOLVING THIS MATERIAL, CALL DAY OR NIGHT (800) 231-1366
OR CALL CHEMTREC AT (800) 424-9300



ADDITIONAL DATA

Recommended First Aid Treatment: (Continued)

Eye Contact: PERSONS WITH POTENTIAL EXPOSURE TO HYDROGEN SULFIDE SHOULD NOT WEAR CONTACT LENSES.

Flush contaminated eye(s) with copious quantities of water. Part eyelids with fingers to assure complete flushing. Continue for at least 15 minutes.

Other Recommendations or Precautions: (Continued)

compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR).

SPECIAL PROTECTION INFORMATION

Page 1

RESPIRATORY PROTECTION (Specify type) Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.		
VENTILATION Hood with forced ventilation.	LOCAL EXHAUST To prevent accumulation above the TWA for H ₂ S MECHANICAL (Gen.)	SPECIAL OTHER
PROTECTIVE GLOVES Neoprene or butyl rubber, PVC, polyethylene		
EYE PROTECTION Safety goggles or glasses		
OTHER PROTECTIVE EQUIPMENT Safety shoes, safety shower, eyewash "fountains"		

SPECIAL PRECAUTIONS***SPECIAL LABELING INFORMATION**

DOT Shipping Name: Hydrogen sulfide (RQ-100/45.4) I.D. No.: UN 1053
DOT Hazard Class: Flammable gas DOT Shipping Label: Flammable gas, Poison

SPECIAL HANDLING RECOMMENDATIONS

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<750 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

For additional handling recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130F (54C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first-in-first-out" inventory system to prevent full cylinders being stored for excessive periods of time. Post "No Smoking or Open Flames" signs in the storage or use area. There should be no sources of ignition in the storage or use area.

For additional storage recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL PACKAGING RECOMMENDATIONS

Many metals corrode rapidly with wet hydrogen sulfide. Anhydrous (water content <-40F or C) hydrogen sulfide can be handled in carbon steel, aluminum, Inconel®, Stellite® and 304 and 316 stainless steels. Avoid hard steels which are highly stressed since they may be susceptible to hydrogen embrittlement from hydrogen sulfide.

OTHER RECOMMENDATIONS OR PRECAUTIONS

Earth-ground and bond all lines and equipment associated with the hydrogen sulfide system. All electrical equipment should be non-sparking or explosion proof. Do not rely on the olfactory sense to detect the presence of hydrogen sulfide. Analytical devices and instrumentation are readily available for this purpose. Perform frequent analytical tests to be certain that the TWA is not being exceeded.

Compressed gas cylinders should not be refilled except by qualified producers of
(Continued on last page.)

*Various Government agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage or use of this product which may not be contained herein. The customer or user of this product should be familiar with these regulations.



Material Safety Data Sheet

LIQUID AIR CORPORATION ALPHAGAZ DIVISION One California Plaza, Suite 350 2121 N. California Blvd. Walnut Creek, California 94596	PRODUCT NAME Isobutylene	CAS NUMBER 115-11-7
	TELEPHONE (415) 977-6500 EMERGENCY RESPONSE INFORMATION ON PAGE 2	
	TRADE NAME AND SYNONYMS Isobutylene	
ISSUE DATE OCTOBER 1, 1985 AND REVISIONS CORPORATE SAFETY DEPT.	CHEMICAL NAME AND SYNONYMS Isobutene, Isobutylene, 2-Methylpropene	CHEMICAL FAMILY Monolefin
	FORMULA (iso) C ₄ H ₈	
MOLECULAR WEIGHT 56.03		

See last page.

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT Isobutylene is defined as a simple asphyxiant. Oxygen levels should be maintained at greater than 18 molar percent at normal atmospheric pressure which is equivalent to a partial pressure of 135 mm Hg. (ACGIH, 1984-85)

SYMPTOMS OF EXPOSURE

Inhalation: Moderate concentrations so as to exclude an adequate supply of oxygen to the lungs causes dizziness, drowsiness and eventual unconsciousness. It also has a very mild anesthetic effect which might cause lack of co-ordination or lessened mental alertness.

Skin and Eye Contact: It is mildly irritating to mucous membranes. Due to its rapid rate of evaporation, it can cause tissue freezing or frostbite on dermal contact.

TOXICOLOGICAL PROPERTIES

It has a very mild anesthetic effect; however, the major property is the exclusion of an adequate supply of oxygen to the lungs.

Frostbite effects are a change in color of the skin to gray or white possibly followed by blistering.

Listed as Carcinogen
or Potential Carcinogen

National Toxicology
Program Yes ☐
No ☒

I.A.R.C.
Monographs Yes ☐
No ☒

OSHA Yes ☐
No ☒

RECOMMENDED FIRST AID TREATMENT

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO ISOBUTYLENE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS AND BE COGNIZANT OF EXTREME FIRE AND EXPLOSION HAZARD.

Inhalation: Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given mouth-to-mouth resuscitation and supplemental oxygen. Medical assistance should be sought immediately.

Dermal Contact or Frostbite: Remove contaminated clothing and flush affected areas
(Continued on last page.)

Judgements as to the suitability of information herein for purchaser's purposes are necessarily purchaser's responsibility. Therefore, although reasonable care has been taken in the preparation of such information, Liquid Air Corporation extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to purchaser intended purposes or consequences of its use. Since Liquid Air Corporation has no control over the use of this product, it assumes no liability for damage or loss of product resulting from proper (or improper) use or application of the product. Data Sheets may be changed from time to time. Be sure to consult the latest edition.

ORIGINAL

Isobutylene is flammable over a wide range in air.

PHYSICAL DATA

BOILING POINT 19.18°F (-7.12°C)	LIQUID DENSITY AT BOILING POINT 39.09 lb/ft ³ (626.2 kg/m ³)
VAPOR PRESSURE @ 70°F (21.1°C) = 38.43 psia (265 kPa)	GAS DENSITY AT 70°F 1 atm .148 lb/ft ³ (2.37 kg/m ³)
SOLUBILITY IN WATER Insoluble	FREEZING POINT -220.63°F (-140.35°C)
APPEARANCE AND ODOR Colorless gas with an unpleasant odor similar to that which is emitted when burning anthracite coal. Specific gravity @70°F (Air = 1.0) is 1.98.	

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED) -105°F (-76°C) Closed cup	AUTO IGNITION TEMPERATURE 869°F (465°C)	FLAMMABLE LIMITS % BY VOLUME LEL: 1.8 UEL: 9.6
EXTINGUISHING MEDIA Water, carbon dioxide, dry chemical		ELECTRICAL CLASSIFICATION Class 1, Group not specified
SPECIAL FIRE FIGHTING PROCEDURES If possible, stop the flow of isobutylene. Use water spray to cool surrounding containers.		
UNUSUAL FIRE AND EXPLOSION HAZARDS Isobutylene is heavier than air and may travel a considerable distance to a source of ignition. Should flame be extinguished and flow of gas continue, increase ventilation to prevent flammable mixture formation in low areas or pockets.		

REACTIVITY DATA

STABILITY Unstable		CONDITIONS TO AVOID
Stable	X	
INCOMPATIBILITY (Materials to avoid) Oxidizers		
HAZARDOUS DECOMPOSITION PRODUCTS None		
HAZARDOUS POLYMERIZATION May Occur		CONDITIONS TO AVOID
Will Not Occur	X	

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is in container or container valve, contact the closest Liquid Air Corporation location.

WASTE DISPOSAL METHOD

Do not attempt to dispose of waste or unused quantities. Return in the shipping container properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place to Liquid Air Corporation for proper disposal. For emergency disposal, contact the closest Liquid Air Corporation location.

EMERGENCY RESPONSE INFORMATION

IN CASE OF EMERGENCY INVOLVING THIS MATERIAL, CALL DAY OR NIGHT (800) 231-1366
OR CALL CHEMTREC AT (800) 424-9300



ADDITIONAL DATA

RECOMMENDED FIRST AID TREATMENT: (Continued)

with lukewarm water. DO NOT USE HOT WATER. A physician should see the patient promptly if the cryogenic "burn" has resulted in blistering of the dermal surface or deep tissue freezing.

TIME WEIGHTED AVERAGE EXPOSURE LIMIT (Continued)

TWA (OSHA, 1985) for LPG (Liquefied Petroleum Gas) is 1,000 molar PPM.

SPECIAL PROTECTION INFORMATION

Page 1

ORIGINAL

RESPIRATORY PROTECTION (Specify type) Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.		
VENTILATION Hood with forced ventilation	LOCAL EXHAUST To prevent accumulation above the LEL.	SPECIAL
	MECHANICAL (Gen.) In accordance with electrical codes.	OTHER
PROTECTIVE GLOVES Plastic or rubber		
EYE PROTECTION Safety goggles or glasses		
OTHER PROTECTIVE EQUIPMENT Safety shoes, safety shower, eyewash "fountain"		

SPECIAL PRECAUTIONS***SPECIAL LABELING INFORMATION**

DOT Shipping Name: Liquefied petroleum gas DOT Hazard Class: Flammable gas
DOT Shipping Label: Flammable gas I.D. No.: UN 1075

SPECIAL HANDLING RECOMMENDATIONS

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (≤ 250 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

For additional handling recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130F (54C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time. Post "No Smoking or Open Flames" signs in the storage or use area. There should be no sources of ignition in the storage or use area.

For additional storage recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL PACKAGING RECOMMENDATIONS

Isobutylene is noncorrosive and may be used with any common structural material.

OTHER RECOMMENDATIONS OR PRECAUTIONS

Earth-ground and bond all lines and equipment associated with the isobutylene system. Electrical equipment should be non-sparking or explosion proof. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR).

*Various Government agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage or use of this product which may not be contained herein. The customer or user of this product should be familiar with these regulations.



Material Safety Data Sheet

LIQUID AIR CORPORATION ALPHAGAZ DIVISION One California Plaza, Suite 350 2121 N. California Blvd. Walnut Creek, California 94596	PRODUCT NAME Methane	
	TELEPHONE (415) 977-6500 EMERGENCY RESPONSE INFORMATION ON PAGE 2	
	TRADE NAME AND SYNONYMS Methane	CAS NUMBER 74-82-8
	CHEMICAL NAME AND SYNONYMS Methane, Methyl Hydride, Marsh Gas	
ISSUE DATE OCTOBER 1, 1985	FORMULA CH ₄	MOLECULAR WEIGHT 16.01
AND REVISIONS CORPORATE SAFETY DEPT.	CHEMICAL FAMILY Aliphatic Hydrocarbon	

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT Methane is defined as a simple asphyxiant. Oxygen levels should be maintained at greater than 18 molar percent at normal atmospheric pressure which is equivalent to a partial pressure of 135 mm Hg. (ACGIH, 1984-85)

SYMPTOMS OF EXPOSURE

Inhalation: High concentrations of methane so as to exclude an adequate supply of oxygen to the lungs causes dizziness, deeper breathing due to air hunger, possible nausea and eventual unconsciousness.

Skin Contact: Contact with cryogenic liquid methane causes cryogenic "burns" or frostbite of dermal tissue.

TOXICOLOGICAL PROPERTIES

Methane is inactive biologically and essentially nontoxic; therefore, the major property is the exclusion of an adequate supply of oxygen to the lungs.

Frostbite effects are a change in color of the skin to gray or white possibly followed by blistering.

Listed as Carcinogen
or Potential Carcinogen

National Toxicology
Program Yes ☐
No ☒

I.A.R.C.
Monographs Yes ☐
No ☒

OSHA Yes ☐
No ☒

RECOMMENDED FIRST AID TREATMENT

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO METHANE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS AND BE COGNIZANT OF EXTREME FIRE AND EXPLOSION HAZARD.

Inhalation: Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given mouth-to-mouth resuscitation and supplemental oxygen. Medical assistance should be sought immediately.

Dermal Contact or Frostbite: Remove contaminated clothing and flush affected areas with lukewarm water. DO NOT USE HOT WATER.

(Continued on last page.)

Judgements as to the suitability of information herein for purchaser's purposes are necessarily purchaser's responsibility. Therefore, although reasonable care has been taken in the preparation of such information, Liquid Air Corporation extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to purchaser's intended purposes or consequences of its use. Since Liquid Air Corporation has no control over the use of this product, it assumes no liability for damage or loss of product resulting from proper (or improper) use or application of the product. Data Sheets may be changed from time to time. Be sure to consult the latest edition.

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

Forms explosive or flammable mixtures with most oxidizers (oxygen, chlorine, fluorine, etc.)

Is flammable over a wide range in air.

PHYSICAL DATA

BOILING POINT -258.74°F (-161.52°C)	LIQUID DENSITY AT BOILING POINT 26.383 lb/ft ³ (422.62 kg/m ³)
VAPOR PRESSURE @ 70°F (21.1°C) Above the critical temperature of -116.7°F (-82.62°C)	GAS DENSITY AT 70°F 1 atm .041 lb/ft ³ (.657 kg/m ³)
SOLUBILITY IN WATER @ 68°F (20°C) Bunsen Coefficient = .035	FREEZING POINT -296.45°F (-182.47°C)
APPEARANCE AND ODOR Colorless, odorless gas; liquid is water white.	Specific gravity @70°F (Air = 1.0) is .55.

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED)-306°F (-188°C) Closed Cup		AUTO IGNITION TEMPERATURE 1076°F (580°C)	FLAMMABLE LIMITS % BY VOLUME LEL=5 UEL=15	
EXTINGUISHING MEDIA Water, carbon dioxide, dry chemical			ELECTRICAL CLASSIFICATION Class 1, Group D	
SPECIAL FIRE FIGHTING PROCEDURES If possible, stop the flow of methane. Use water spray to cool surrounding containers.				
UNUSUAL FIRE AND EXPLOSION HAZARDS Should flame be extinguished and flow of gas continue, increase ventilation to prevent flammable or explosible mixture formation.				

REACTIVITY DATA

STABILITY Unstable		CONDITIONS TO AVOID
Stable	X	
INCOMPATIBILITY (Materials to avoid) Oxidizers		
HAZARDOUS DECOMPOSITION PRODUCTS None		
HAZARDOUS POLYMERIZATION May Occur		CONDITIONS TO AVOID
Will Not Occur	X	

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is in container or container valve, contact the closest Liquid Air Corporation location.

WASTE DISPOSAL METHOD

Do not attempt to dispose of waste or unused quantities. Return in the shipping container properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place to Liquid Air Corporation for proper disposal. For emergency disposal, contact the closest Liquid Air Corporation location.

EMERGENCY RESPONSE INFORMATION

IN CASE OF EMERGENCY INVOLVING THIS MATERIAL, CALL DAY OR NIGHT (800) 231-1366
OR CALL CHEMTREC AT (800) 424-9300



ORIGINAL

ADDITIONAL DATA

RECOMMENDED FIRST AID TREATMENT: (Continued)

A physician should see the patient promptly if the cryogenic "burn" has resulted in blistering of the dermal surface or deep tissue freezing.

SPECIAL LABELING INFORMATION: (Continued)

For cryogenic liquid methane:

DOT Shipping Name: Methane, refrigerated liquid
Shipping Label: Flammable gas
DOT Hazard Class: Flammable gas
I.D. No.: UN 1972

SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type) Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.

VENTILATION	LOCAL EXHAUST	SPECIAL
Hood with forced ventilation	To prevent accumulation above the LEL.	
	MECHANICAL (Gen.)	OTHER
	In accordance with electrical codes.	

PROTECTIVE GLOVES
Plastic or rubber

EYE PROTECTION
Safety goggles or glasses

OTHER PROTECTIVE EQUIPMENT
Safety shoes, safety shower, eyewash "fountain"

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION (Note: For cryogenic liquid methane, see last page.)
DOT Shipping Name: Methane DOT Hazard Class: Flammable Gas
DOT Shipping Label: Flammable Gas ID No.: UN 1971

SPECIAL HANDLING RECOMMENDATIONS

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3,000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

For additional handling recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130F (54C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time. Post "No Smoking or Open Flames" signs in the storage or use area. There should be no sources of ignition in the storage or use area.

For additional storage recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL PACKAGING RECOMMENDATIONS

Methane is noncorrosive and may be used with any common structural material.

OTHER RECOMMENDATIONS OR PRECAUTIONS

Earth-ground and bond all lines and equipment associated with the methane system. Electrical equipment should be non-sparking or explosion proof. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR).

*Various Government agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage or use of this product which may not be contained herein. The customer or user of this product should be familiar with these regulations.

Electronics Group

2330 HAMILTON BOULEVARD, P.O. BOX 648, SOUTH PLAINFIELD, N.J. 07080 (201) 754-7700

1333 ORIGINAL

REGIONAL PHONE NUMBERS

PA (215) 766-8861	CA (714) 887-2571	MI (313) 589-2950	TX (713) 844-4620
NJ (201) 754-7700	CA (415) 659-0162	CO (303) 442-4700	MA (617) 245-8707

MATERIAL SAFETY DATA SHEET

SECTION I - MATERIAL IDENTIFICATION

CHEMICAL NAME: Hydrogen SUPPLIER: Scott Specialty Gases

CHEMICAL FORMULA: H_2 ADDRESS: Route 611 Plumsteadville, PA 18949

CHEMICAL FAMILY: Elemental Gas, Diatomic IN CASE OF EMERGENCY, CONTACT YOUR REGIONAL PLANT MANAGER

DATE PREPARED: 1/9/89 OTHER DESIGNATIONS: CAS# 1333-74-0

SECTION II - HAZARDOUS INGREDIENTS

COMPONENT	CONCENTRATION	EXPOSURE LIMITS (PPM)		
		ACGIH	OSHA	
		TLV	PEL	OTHER
Hydrogen	100%			None - Simple Asphyxiant

SECTION III - PHYSICAL DATA

BOILING POINT: $-423^{\circ}F$ SPECIFIC GRAVITY ($H_2O = 1$): Gas

VAPOR PRESSURE @ $20^{\circ}C$: Gas PERCENT, VOLATILE BY VOLUME (%): Gas

VAPOR DENSITY (AIR = 1) @ $25^{\circ}C$: 0.069 EVAPORATION RATE (_____ = 1): Gas

SOLUBILITY IN WATER @ $20^{\circ}C$: v/v 0.019 APPEARANCE AND ODOR: Colorless, odorless gas

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT AND METHOD	FLAMMABLE LIMITS	LEL	UEL
Gas	Vol. % in air	4%	75%

EXTINGUISHING MEDIA: Dry chemical or carbon dioxide, halogenated gas.

SPECIAL FIRE FIGHTING PROCEDURES: Do not extinguish hydrogen fire unless the flow of hydrogen gas can be stopped at the source. Keep fire-exposed cylinders cool with water spray.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Severe when exposed to heat or flame. Will react violently with oxidizing materials. Flash danger is present. Pure hydrogen burns with a pale, blue, nearly invisible flame.

SECTION V - REACTIVITY DATA

STABILITY: Stable under normal storage conditions.

DISCLAIMER: The information in this Material Safety Data Sheet is offered without charge for use by technically qualified personnel at their discretion and risk. Scott Specialty Gases has made this sheet available with data we believe is reliable, but the accuracy and completeness of the data is not guaranteed and no warranty is either expressed or implied. Since Scott Specialty Gases has no control over the use of the product described herein, we assume no liability for loss or damage incurred from the proper or improper use of such product. This form is essentially similar to U.S. Department of Labor form OSHA-20.

ORIGINAL
HAZARDOUS DECOMPOSITION PRODUCTS: None
HAZARDOUS POLYMERIZATION: Will not occur

SECTION VI - HEALTH HAZARD DATA

ROUTES OF ENTRY: Inhalation

EFFECTS OF OVER EXPOSURE (ACUTE): Mixture acts as a simple asphyxiant by displacing air necessary for life. Symptoms include rapid respiration, muscular incoordination, fatigue, nausea and vomiting, and unconsciousness. (CHRONIC): None (MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE): None known.

CARCINOGENICITY - NTP? NO IARC MONOGRAPHS? NO OSHA REGULATED? NO

EMERGENCY AND FIRST AID: Immediately remove victim to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN: Evacuate and ventilate area. Electrical equipment should be explosion-proof.

WASTE DISPOSAL METHOD: Remove leaking container to safe outdoors area or a ventilated hood if this can be done safely. Allow gas to discharge at a slow rate and return defective cylinder to supplier. Restrict access to leaking cylinder due to potential for ignition and nearly invisible flame.

SECTION VIII - SPECIAL PROTECTION INFORMATION

APPENDIX 16

RESPIRATORY PROTECTION (SPECIFY TYPE): Use a self-contained breathing apparatus in case of emergency or non-routine use.

HAZARD EVALUATION FLOW CHART

VENTILATION: Explosion-proof ventilation equipment is recommended to maintain adequate supply of fresh air and to keep concentration of hydrogen well below flammable limits.

OTHER PROTECTIVE EQUIPMENT: Protective gloves recommended when handling cylinder, safety glasses, safety shoes when handling cylinders.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: Quantities greater than 400 standard cu. ft. should be store in specially ventilated rooms or outside. Store away from oxidizers, combustible materials and sources of heat or ignition. Ventilation equipment should be explosion-proof. Return to supplier with positive pressure. Never expose any part of the cylinder to temperatures above 125°F.

OTHER PRECAUTIONS: Do not deface cylinders or labels. Move cylinder with adequate hand truck. Cylinders should be refilled by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his written consent is a violation of federal law (49 CFR).

1-IX(01)

MATERIAL SAFETY DATA SHEET

UNOCAL 76

ORIGINAL

1201 West 5th Street
Los Angeles, California 90017Product Name: 76 UNLEADED 89 GASOLINE
Product Code No: 00470Page 1
Issue Date: 04/15/91
Status: FINAL

Responsible Party:

UNOCAL REFINING & MARKETING DIVISION
UNION OIL COMPANY OF CALIFORNIA
1201 WEST 5TH STREET
LOS ANGELES, CALIFORNIA 90017CONTACT FOR FURTHER INFORMATION:
MSDS COORDINATOR 213-977-7589

Transportation Emergencies:

CHEMTREC
(800) 424-9300 Cont. U.S.
(202) 483-7616 (Collect)
from Alaska & Hawaii
Health Emergencies:
LOS ANGELES POISON
CONTROL CENTER (24 hrs)
(800) 356-3129

PRODUCT IDENTIFICATION

PRODUCT NAME: 76 UNLEADED 89 GASOLINE
GENERIC NAME: UNLEADED GASOLINE
CHEMICAL FAMILY: PETROLEUM HYDROCARBON MIXTURE
DOT PROPER
SHIPPING NAME: GASOLINE
ID NUMBER: UN1203
DOT HAZARD
CLASSIFICATION: FLAMMABLE LIQUID

PRECAUTIONARY WARNING

DANGER

EXTREMELY FLAMMABLE. VAPORS MAY EXPLODE. HARMFUL OR FATAL IF SWALLOWED. VAPOR HARMFUL. ASPIRATION HAZARD IF SWALLOWED. CAN ENTER LUNGS AND CAUSE DAMAGE. POSSIBLE CANCER HAZARD BASED ON TESTS WITH LABORATORY ANIMALS. NO SMOKING OR OPEN FLAME. KEEP AWAY FROM HEAT, SPARKS, FLAMES OR OTHER SOURCES OF IGNITION (e.g. STATIC ELECTRICITY, PILOT LIGHTS OR MECHANICAL/ELECTRICAL EQUIPMENT). VAPORS MAY BE IGNITED BY SPARK OR FLAME SOURCE MANY FEET AWAY. DO NOT OVERFILL TANK. USE ONLY WITH ADEQUATE VENTILATION. DO NOT TASTE OR SWALLOW. DO NOT BREATHE VAPOR OR MIST. DO NOT GET IN EYES, ON SKIN OR ON CLOTHING. WASH THOROUGHLY AFTER HANDLING. NEVER SIPHON BY MOUTH. FOR USE AS MOTOR FUEL ONLY. DO NOT USE FOR ANY OTHER PURPOSE. KEEP CONTAINER CLOSED. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, GRIND OR DRILL ON OR NEAR CONTAINER. "EMPTY" CONTAINER RETAINS RESIDUE (LIQUID AND/OR VAPOR) AND MAY EXPLODE IN HEAT OF A FIRE. KEEP OUT OF REACH OF CHILDREN. FAILURE TO USE CAUTION MAY CAUSE SERIOUS INJURY OR ILLNESS.

SECTION I - COMPONENTS PERCENT EXPOSURE LIMIT UNITS AGENCY TYPE

HAZARDOUS COMPONENTS

GASOLINE
CAS #: 8006-61-9

300.000	ppm	ACGIH	TWA
500.000	ppm	ACGIH	STEL
300.000	ppm	OSHA	TWA
500.000	ppm	OSHA	STEL
300.000	ppm	CAL OSHA	TWA

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SECTION I - COMPONENTS	PERCENT	EXPOSURE LIMIT	UNITS	AGENCY	TY
BENZENE CAS #: 71-43-2	1.000 - 5.000	10.000 25.000 1.000 5.000 50.000 25.000 10.000	ppm ppm ppm ppm ppm ppm ppm	ACGIH MSHA OSHA OSHA CAL OSHA CAL OSHA CAL OSHA	TWA CEIL- TWA STEL CEIL EXCUR TWA-S
TOLUENE CAS #: 108-88-3	1.000 - 9.000	100.000 150.000 100.000 100.000 150.000 200.000 100.000 500.000	ppm ppm ppm ppm ppm ppm ppm ppm	ACGIH ACGIH MSHA OSHA OSHA CAL OSHA CAL OSHA CAL OSHA	TWA STEL TWA TWA STEL EXCUR TWA-S CEIL
XYLENES CAS #: 1330-20-7	1.000 - 14.000	100.000 150.000 100.000 100.000 150.000 200.000 100.000 300.000	ppm ppm ppm ppm ppm ppm ppm ppm	ACGIH ACGIH MSHA OSHA OSHA CAL OSHA CAL OSHA CAL OSHA	TWA STEL TWA TWA STEL EXCU TWA- CEIL
N-HEXANE CAS #: 110-54-3		50.000 500.000 50.000 50.000	ppm ppm ppm ppm	ACGIH MSHA OSHA CAL OSHA	TWA TWA TWA TWA
ETHYLBENZENE CAS #: 100-41-4	1.000 - 5.000	100.000 125.000 100.000 100.000 125.000 100.000	ppm ppm ppm ppm ppm ppm	ACGIH ACGIH MSHA OSHA OSHA CAL OSHA	TWA STEL TWA TWA STEL TWA
1,2,4-TRIMETHYLBENZENE CAS #: 95-63-6	1.000 - 5.000				NOT ESTABLISHED

OTHER COMPONENTS

--NONE--

THIS PRODUCT CONTAINS THE FOLLOWING CHEMICALS SUBJECT TO THE REPORTING REQUIREMENTS OF SARA 313 AND 40 CFR 372:

	CAS NUMBER	WEIGHT
BENZENE	71-43-2	1-5
TOLUENE	108-88-3	1-9
XYLENES	1330-20-7	1-14
ETHYLBENZENE	100-41-4	1-5
METHYL TERT-BUTYL ETHER	1634-04-4	0-10
1,2,4-TRIMETHYLBENZENE	95-63-6	1-5

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Status: FINAL**SECTION II - EMERGENCY AND FIRST AID PROCEDURES*******EMERGENCY*****Have physician call LOS ANGELES POISON
CONTROL CENTER (24 hrs) (800) 356-3129**EYE CONTACT:**

IF IRRITATION OR REDNESS DEVELOPS, MOVE VICTIM AWAY FROM EXPOSURE AND INTO FRESH AIR. FLUSH EYES WITH CLEAN WATER. IF SYMPTOMS PERSIST, SEEK MEDICAL ATTENTION.

SKIN CONTACT:

WIPE MATERIAL FROM SKIN AND REMOVE CONTAMINATED SHOES AND CLOTHING. CLEANSE AFFECTED AREA(S) THOROUGHLY BY WASHING WITH MILD SOAP AND WATER AND, IF NECESSARY, A WATERLESS SKIN CLEANSER. IF IRRITATION OR REDNESS DEVELOPS AND PERSISTS, SEEK MEDICAL ATTENTION.

INHALATION (BREATHING):

IF RESPIRATORY SYMPTOMS OR OTHER SYMPTOMS OF EXPOSURE DEVELOP, MOVE VICTIM AWAY FROM SOURCE OF EXPOSURE AND INTO FRESH AIR. IF SYMPTOMS PERSIST, SEEK IMMEDIATE MEDICAL ATTENTION. IF VICTIM IS NOT BREATHING, IMMEDIATELY BEGIN ARTIFICIAL RESPIRATION. IF BREATHING DIFFICULTIES DEVELOP, OXYGEN SHOULD BE ADMINISTERED BY QUALIFIED PERSONNEL. SEEK IMMEDIATE MEDICAL ATTENTION.

INGESTION (SWALLOWING):

ASPIRATION HAZARD: DO NOT INDUCE VOMITING OR GIVE ANYTHING BY MOUTH BECAUSE THIS MATERIAL CAN ENTER THE LUNGS AND CAUSE SEVERE LUNG DAMAGE. IF VICTIM IS DROWSY OR UNCONSCIOUS, PLACE ON THE LEFT SIDE WITH THE HEAD DOWN. IF POSSIBLE, DO NOT LEAVE VICTIM UNATTENDED. SEEK MEDICAL ATTENTION.

COMMENTS:

NOTE TO PHYSICIANS: EXPOSURE TO HIGH CONCENTRATIONS OF THIS MATERIAL (e.g. IN ENCLOSED SPACES OR WITH DELIBERATE ABUSE) MAY BE ASSOCIATED WITH CARDIAC ARRHYTHMIAS. EPINEPHRINE AND OTHER SYMPATHOMIMETIC DRUGS MAY INITIATE CARDIAC ARRHYTHMIAS IN PERSONS EXPOSED TO THIS MATERIAL. OTHER DRUGS WITH LESS ARRHYTHMOGENIC POTENTIAL SHOULD BE CONSIDERED. IF SYMPATHOMIMETIC DRUGS ARE ADMINISTERED, OBSERVE FOR THE DEVELOPMENT OF CARDIAC ARRHYTHMIAS.

SECTION III - HEALTH HAZARDS/ROUTES OF ENTRY**EYE CONTACT:**

THIS MATERIAL MAY CAUSE MILD EYE IRRITATION. DIRECT CONTACT WITH THE LIQUID OR EXPOSURE TO VAPORS OR MISTS MAY CAUSE STINGING, TEARING AND REDNESS.

SKIN CONTACT:

THIS MATERIAL MAY CAUSE MILD SKIN IRRITATION. PROLONGED OR REPEATED CONTACT MAY CAUSE REDNESS, BURNING, AND DRYING AND CRACKING OF THE SKIN. CONTACT MAY RESULT IN SKIN ABSORPTION BUT SYMPTOMS OF TOXICITY ARE NOT ANTICIPATED BY THIS ROUTE ALONE UNDER NORMAL CONDITIONS OF USE. PERSONS WITH PRE-EXISTING SKIN DISORDERS MAY BE MORE SUSCEPTIBLE TO THE EFFECTS OF THIS MATERIAL.

INHALATION (BREATHING):

WHILE THIS MATERIAL HAS A LOW DEGREE OF TOXICITY, BREATHING HIGH CONCENTRATIONS OF VAPORS OR MISTS MAY CAUSE FLUSHING, BLURRED VISION, NAUSEA AND SIGNS OF NERVOUS SYSTEM DEPRESSION (e.g. HEADACHE, DROWSINESS, DIZZINESS, LOSS OF COORDINATION AND FATIGUE). EXPOSURE TO HIGH CONCENTRATIONS MAY CAUSE LOSS OF CONSCIOUSNESS, CONVULSIONS, RESPIRATORY COLLAPSE AND DEATH. RESPIRATORY SYMPTOMS ASSOCIATED WITH PRE-EXISTING LUNG DISORDERS (e.g. ASTHMA-LIKE CONDITIONS) MAY BE AGGRAVATED BY EXPOSURE TO THIS MATERIAL.

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SECTION III - HEALTH HAZARDS/ROUTES OF ENTRY

INGESTION (SWALLOWING):

ASPIRATION HAZARD - THIS MATERIAL CAN ENTER LUNGS DURING SWALLOWING OR VOMITING CAUSE LUNG INFLAMMATION AND DAMAGE. INGESTION OF EXCESSIVE QUANTITIES OF THIS M. MAY CAUSE IRRITATION OF THE DIGESTIVE TRACT AND SIGNS OF NERVOUS SYSTEM DEPRESS (e.g. HEADACHE, DROWSINESS, DIZZINESS, LOSS OF COORDINATION, AND FATIGUE).

COMMENTS:

GASOLINE IS A POSSIBLE CANCER HAZARD BASED ON TESTS IN LABORATORY ANIMALS. FOR STUDIES SUGGEST THAT THIS MAY BE A UNIQUE EFFECT IN MALE RATS. UNLEADED GASOLINE BEEN IDENTIFIED AS A POSSIBLE CARCINOGEN BY IARC. BENZENE, A COMPONENT OF THIS PRODUCT, IS A KNOWN CANCER (LEUKEMIA) HAZARD. RESULTS OF TESTS IN HUMANS HAVE THAT EXPOSURE TO BENZENE CAN CAUSE IRREVERSIBLE CHANGES IN THE GENETIC MATERIAL OF A CELL. THE HUMAN HEALTH CONSEQUENCES OF THESE CHANGES IS NOT FULLY UNDERSTOOD. BENZENE HAS BEEN IDENTIFIED AS A CARCINOGEN BY IARC, NTP AND OSHA. THERE IS INSUFFICIENT EVIDENCE TO SHOW THAT GASOLINE POSES ANY HAZARD RELATED TO ITS LOW BENZENE CONTENT. PERSONS WITH PRE-EXISTING HEART DISORDERS MAY BE MORE SUSCEPTIBLE TO IRREGULAR HEARTBEATS (ARRHYTHMIAS) IF EXPOSED TO HIGH CONCENTRATIONS OF THIS MATERIAL (SEE SECTION II - NOTE TO PHYSICIANS). GASOLINE ENGINE EXHAUST HAS BEEN IDENTIFIED AS A POSSIBLE HUMAN CANCER HAZARD BY IARC. THIS CLASSIFICATION IS BASED ON THE FINDINGS THAT SOLVENT EXTRACTS OF GASOLINE EXHAUST SOOT CAUSED SKIN CANCER IN LABORATORY ANIMALS.

SECTION IV - SPECIAL PROTECTION INFORMATION

VENTILATION:

IF CURRENT VENTILATION PRACTICES ARE NOT ADEQUATE TO MAINTAIN AIRBORNE CONCENTRATION BELOW THE ESTABLISHED EXPOSURE LIMITS (SEE SECTION I), ADDITIONAL VENTILATION OR EXHAUST SYSTEMS MAY BE REQUIRED. WHERE EXPLOSIVE MIXTURES MAY BE PRESENT, VENTILATION SYSTEMS SAFE FOR SUCH LOCATIONS MUST BE USED.

RESPIRATORY PROTECTION:

THE USE OF RESPIRATORY PROTECTION IS ADVISED WHEN CONCENTRATIONS EXCEED THE ESTABLISHED EXPOSURE LIMITS (SEE SECTION I). DEPENDING ON THE AIRBORNE CONCENTRATION, USE A RESPIRATOR OR GAS MASK WITH APPROPRIATE CARTRIDGES AND CANNISTERS (NIOSH APPROVED, IF AVAILABLE) OR SUPPLIED AIR EQUIPMENT.

PROTECTIVE GLOVES:

THE USE OF GLOVES IMPERMEABLE TO THE SPECIFIC MATERIAL HANDLED IS ADVISED TO PREVENT SKIN CONTACT AND POSSIBLE IRRITATION.

EYE PROTECTION:

APPROVED EYE PROTECTION TO SAFEGUARD AGAINST POTENTIAL EYE CONTACT, IRRITATION, AND INJURY IS RECOMMENDED.

OTHER PROTECTIVE EQUIPMENT:

IT IS SUGGESTED THAT A SOURCE OF CLEAN WATER BE AVAILABLE IN THE WORK AREA FOR FLUSHING EYES AND SKIN. IMPERVIOUS CLOTHING SHOULD BE WORN AS NEEDED.

SECTION V - REACTIVITY DATA

REACTIVITY:

STABLE UNDER NORMAL CONDITIONS OF STORAGE AND HANDLING.

EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE.

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SECTION V - REACTIVITY DATA**CONDITIONS AFFECTING REACTIVITY:**

AVOID ALL POSSIBLE SOURCES OF IGNITION (SEE SECTIONS VII AND VIII).

INCOMPATIBLE MATERIALS:

CONTACT WITH STRONG OXIDIZING AGENTS SUCH AS CHLORINE, PERMANGANATES AND DICHROMATES MAY CAUSE FIRE OR EXPLOSION.

HAZARDOUS DECOMPOSITION PRODUCTS:

COMBUSTION MAY YIELD SIGNIFICANT AMOUNTS OF CARBON MONOXIDE AND SMALL AMOUNTS OF OXIDES OF SULFUR AND NITROGEN, BENZENE AND OTHER ORGANIC COMPOUNDS.

HAZARDOUS POLYMERIZATION:

WILL NOT OCCUR

POLYMERIZATION CONDITIONS TO AVOID:

NONE KNOWN

SECTION VI - SPILL AND LEAK PROCEDURES *HIGHWAY OR RAILWAY SPILLS*****
Call CHEMTREC (800) 424-9300 Cont. U.S.
(Collect) (202) 483-7616 from Alaska & Hawaii

PRECAUTIONS IN CASE OF RELEASE OR SPILL:

EXTREMELY FLAMMABLE. KEEP ALL SOURCES OF IGNITION AND HOT METAL SURFACES AWAY FROM SPILL/RELEASE. STAY UPWIND AND AWAY FROM SPILL/RELEASE. ISOLATE HAZARD AREA AND LIMIT ENTRY TO EMERGENCY CREW. STOP SPILL/RELEASE IF IT CAN BE DONE WITHOUT RISK. WEAR APPROPRIATE PROTECTIVE EQUIPMENT INCLUDING RESPIRATORY PROTECTION AS CONDITIONS WARRANT (SEE SECTION IV). PREVENT SPILLED MATERIAL FROM ENTERING SEWERS, STORM DRAINS, OTHER UNAUTHORIZED TREATMENT DRAINAGE SYSTEMS AND NATURAL WATERWAYS. DIKE FAR AHEAD OF SPILL FOR LATER RECOVERY OR DISPOSAL. SPILLED MATERIAL MAY BE ABSORBED INTO AN APPROPRIATE ABSORBENT MATERIAL. NOTIFY FIRE AUTHORITIES AND APPROPRIATE FEDERAL, STATE AND LOCAL AGENCIES. IMMEDIATE CLEANUP OF ANY SPILL IS RECOMMENDED. IF SPILL OF ANY AMOUNT IS MADE INTO OR UPON U.S. NAVIGABLE WATERS, THE CONTIGUOUS ZONE, OR ADJOINING SHORELINES, NOTIFY THE NATIONAL RESPONSE CENTER (PHONE NUMBER 800-424-8802).

WASTE DISPOSAL METHOD:

DISPOSE OF PRODUCT IN ACCORDANCE WITH LOCAL, COUNTY, STATE, AND FEDERAL REGULATIONS.

SECTION VII - STORAGE AND SPECIAL PRECAUTIONS**HANDLING AND STORAGE PRECAUTIONS:**

KEEP CONTAINER(S) TIGHTLY CLOSED. USE AND STORE THIS MATERIAL IN COOL, DRY, WELL VENTILATED AREAS AWAY FROM HEAT, DIRECT SUNLIGHT, HOT METAL SURFACES AND ALL SOURCES OF IGNITION. POST AREA "NO SMOKING OR OPEN FLAME." BOND AND GROUND ALL EQUIPMENT WHEN TRANSFERRING FROM ONE VESSEL TO ANOTHER. STORE ONLY IN APPROVED CONTAINERS. KEEP AWAY FROM ANY INCOMPATIBLE MATERIALS (SEE SECTION V). PROTECT CONTAINER(S) AGAINST PHYSICAL DAMAGE. THE USE OF EXPLOSION-PROOF EQUIPMENT IS RECOMMENDED AND MAY BE REQUIRED (SEE APPROPRIATE FIRE CODES.) DO NOT ENTER CONFINED SPACES SUCH AS TANKS OR PITS WITHOUT FOLLOWING PROPER ENTRY PROCEDURES SUCH AS ASTM D-4276. OUTDOOR OR DETACHED STORAGE IS PREFERRED. INDOOR STORAGE SHOULD MEET OSHA STANDARDS AND APPROPRIATE FIRE CODES. THE USE OF RESPIRATORY PROTECTION IS ADVISED WHEN CONCENTRATIONS EXCEED ANY ESTABLISHED EXPOSURE LIMITS (SEE SECTIONS I AND IV). WASH THOROUGHLY AFTER HANDLING. DO NOT WEAR CONTAMINATED CLOTHING OR SHOES. USE GOOD PERSONAL HYGIENE PRACTICE. "EMPTY" CONTAINERS RETAIN RESIDUE (LIQUID AND/OR VAPOR) AND CAN BE DANGEROUS. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS OR OTHER SOURCES OF IGNITION; THEY MAY EXPLODE

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AND CAUSE INJURY OR DEATH. "EMPTY" DRUMS SHOULD BE COMPLETELY DRAINED, PROPERLY BUNGED AND PROMPTLY SHIPPED TO THE SUPPLIER OR A DRUM RECONDITIONER. ALL OTHER CONTAINERS SHOULD BE DISPOSED OF IN AN ENVIRONMENTALLY SAFE MANNER AND IN ACCORDANCE WITH GOVERNMENTAL REGULATIONS. BEFORE WORKING ON OR IN TANKS WHICH CONTAIN OR HAVE CONTAINED THIS PRODUCT, REFER TO OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION REGULATIONS, ANSI Z49.1, AND OTHER GOVERNMENTAL AND INDUSTRIAL REFERENCES PERTAINING TO CLEANING, REPAIRING, WELDING, OR OTHER CONTEMPLATED OPERATIONS.

SECTION VIII - FIRE AND EXPLOSION HAZARD DATA

NFPA HAZARD CLASS	HEALTH HAZARD: FLAMMABILITY: REACTIVITY: OTHER:	HAZARD RANKING 0 = LEAST 1 = SLIGHT 2 = MODERATE 3 = HIGH 4 = EXTREME	FLASH POINT -45 F (TCC)
	2 3 0		

EXTINGUISHING MEDIA:

DRY CHEMICAL, CARBON DIOXIDE, HALON, FOAM OR WATER SPRAY IS RECOMMENDED. WATER BE INEFFECTIVE.

UNUSUAL FIRE & EXPLOSION HAZARDS:

THIS MATERIAL IS EXTREMELY FLAMMABLE AND MAY BE IGNITED BY HEAT, SPARKS, FLAME OR OTHER SOURCES OF IGNITION (e.g. STATIC ELECTRICITY, PILOT LIGHTS, MECHANICAL/ELECTRICAL EQUIPMENT). VAPORS MAY TRAVEL CONSIDERABLE DISTANCES TO A SOURCE OF IGNITION WHERE THEY MAY IGNITE, FLASHBACK OR EXPLODE. VAPOR/AIR EXPLOSION HAZARD INDOORS/OUTDOORS OR IN SEWERS. VAPORS ARE HEAVIER THAN AIR AND MAY ACCUMULATE IN LOW AREAS. IF CONTAINER IS NOT PROPERLY COOLED, IT MAY EXPLODE IN THE HEAT OF FIRE.

SPECIAL FIRE FIGHTING PROCEDURES:

WEAR APPROPRIATE PROTECTIVE EQUIPMENT INCLUDING RESPIRATORY PROTECTION AS CONDITIONS WARRANT (SEE SECTION IV). STOP SPILL/RELEASE IF IT CAN BE DONE WITHOUT RISK. MOVE UNDAMAGED CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. WATER SPRAY BE USEFUL IN MINIMIZING OR DISPERSING VAPORS AND COOLING EQUIPMENT EXPOSED TO HEAT OF FLAME. AVOID SPREADING BURNING LIQUID WITH WATER USED FOR COOLING PURPOSES.

SECTION IX - PHYSICAL DATA

***UNLESS OTHERWISE NOTED, VALUES ARE AT
20 C/68 F AND 760 mm Hg/1 atm.

APPROX BOILING POINT	(AIR = 1) VAPOR DENSITY	(N-BUTYL ACETATE = 1) EVAPORATION RATE	% VOLATILE
85-430F / 29-221C	>1	<1	100
% SOLUBILITY IN WATER			
NEGLECTIBLE			
SPECIFIC GRAVITY			
0.75			
APPEARANCE			
PINK LIQUID			
ODOR			
GASOLINE			

ORIGINAL

Unocal Corporation
1201 West 5th Street, P.O. Box 7600
Los Angeles, California 90051

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MANUFACTURER

UNOCAL REFINING & MARKETING DIVISION
UNION OIL COMPANY OF CALIFORNIA
1201 WEST 5TH STREET
LOS ANGELES, CALIFORNIA 90017

CONTACT FOR FURTHER INFORMATION:
MSDS COORDINATOR 213-977-7589

Transportation Emergencies:

CHEMTREC
(800) 424-9300 Cont. U.S.
(202) 483-7616 (Collect)
from Alaska & Hawaii
Health Emergencies:
Call LOS ANGELES POISON
INFORMATION CENTER (24 hrs)
1-(800)-356-3129

PRODUCT IDENTIFICATION

PRODUCT NAME: 76 UNLEADED SUPER GASOLINE 92

GENERIC NAME: UNLEADED GASOLINE

CHEMICAL FAMILY: PETROLEUM HYDROCARBON MIXTURE

DOT PROPER
SHIPPING NAME: GASOLINE

ID NUMBER: UN1203

DOT HAZARD
CLASSIFICATION: FLAMMABLE LIQUID

SECTION I - COMPONENTS	PERCENT	EXPOSURE LIMIT	UNITS	AGENCY	TYPE
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HAZARDOUS COMPONENTS

GASOLINE
CAS #: 8006-61-9

300.000	ppm	ACGIH	TWA
500.000	ppm	ACGIH	STEL
300.000	ppm	OSHA	TWA
500.000	ppm	OSHA	STEL
300.000	ppm	CAL OSHA	TWA

BENZENE
CAS #: 71-43-2

1.0 - 5.0

10.000	ppm	ACGIH	TWA
25.000	ppm	MSHA	CEIL-SKIN
1.000	ppm	OSHA	TWA
5.000	ppm	OSHA	STEL
50.000	ppm	CAL OSHA	CEIL
25.000	ppm	CAL OSHA	EXCUR
10.000	ppm	CAL OSHA	TWA-SKIN

TOLUENE
CAS #: 108-88-3

1.0 - 9.0

100.000	ppm	ACGIH	TWA
150.000	ppm	ACGIH	STEL
100.000	ppm	MSHA	TWA
100.000	ppm	OSHA	TWA
150.000	ppm	OSHA	STEL
200.000	ppm	CAL OSHA	EXCUR
100.000	ppm	CAL OSHA	TWA-SKIN
500.000	ppm	CAL OSHA	CEIL-SKIN

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SECTION X - DOCUMENTARY INFORMATION

ISSUE DATE: 04/15/91 PRODUCT CODE NO. 00470

PREV. DATE: 05/04/90 PREV. PROD. CODE NO. NONE

MSDS NO: NONE PREV. MSDS NO: NONE

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES

The information in this document is believed to be correct as of the date issued. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THIS INFORMATION, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. This information and product are furnished on the condition that the person receiving them shall make his own determination as to the suitability of the product for his particular purpose and on the condition that he assume the risk of his use thereof.

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SECTION II - EMERGENCY AND FIRST AID PROCEDURES

INGESTION (SWALLOWING):

ASPIRATION HAZARD: DO NOT INDUCE VOMITING OR GIVE ANYTHING BY MOUTH BECAUSE THIS MATERIAL CAN ENTER THE LUNGS AND CAUSE SEVERE LUNG DAMAGE. IF VICTIM IS DROWSY OR UNCONSCIOUS, PLACE ON THE LEFT SIDE WITH THE HEAD DOWN. IF POSSIBLE, DO NOT LEAVE VICTIM UNATTENDED. SEEK MEDICAL ATTENTION.

COMMENTS:

NOTE TO PHYSICIANS: EXPOSURE TO HIGH CONCENTRATIONS OF THIS MATERIAL (E.G., IN ENCLOSED SPACES OR WITH DELIBERATE ABUSE) MAY BE ASSOCIATED WITH CARDIAC ARRHYTHMIAS. EPINEPHRINE AND OTHER SYMPATHOMIMETIC DRUGS MAY INITIATE CARDIAC ARRHYTHMIAS IN PERSONS EXPOSED TO THIS MATERIAL. OTHER DRUGS WITH LESS ARRHYTHMOGENIC POTENTIAL SHOULD BE CONSIDERED. IF SYMPATHOMIMETIC DRUGS ARE ADMINISTERED, OBSERVE FOR THE DEVELOPMENT OF CARDIAC ARRHYTHMIAS.

SECTION III - HEALTH HAZARDS/ROUTES OF ENTRY

EYE CONTACT:

THIS MATERIAL MAY CAUSE MILD EYE IRRITATION. DIRECT CONTACT WITH THE LIQUID OR EXPOSURE TO VAPORS OR MISTS MAY CAUSE STINGING, TEARING AND REDNESS.

SKIN CONTACT:

THIS MATERIAL MAY CAUSE MILD SKIN IRRITATION. PROLONGED OR REPEATED CONTACT MAY CAUSE REDNESS, BURNING, AND DRYING AND CRACKING OF THE SKIN. CONTACT MAY RESULT IN SKIN ABSORPTION BUT SYMPTOMS OF TOXICITY ARE NOT ANTICIPATED BY THIS ROUTE ALONE UNDER NORMAL CONDITIONS OF USE. PERSONS WITH PRE-EXISTING SKIN DISORDERS MAY BE MORE SUSCEPTIBLE TO THE EFFECTS OF THIS MATERIAL.

INHALATION (BREATHING):

WHILE THIS MATERIAL HAS A LOW DEGREE OF TOXICITY, BREATHING HIGH CONCENTRATIONS OF VAPORS OR MISTS MAY CAUSE FLUSHING, BLURRED VISION, NAUSEA AND SIGNS OF NERVOUS SYSTEM DEPRESSION (E.G., HEADACHE, DROWSINESS, DIZZINESS, LOSS OF COORDINATION AND FATIGUE). EXPOSURE TO HIGH CONCENTRATIONS MAY CAUSE LOSS OF CONSCIOUSNESS, CONVULSIONS, RESPIRATORY COLLAPSE AND DEATH. RESPIRATORY SYMPTOMS ASSOCIATED WITH PRE-EXISTING LUNG DISORDERS (E.G., ASTHMA-LIKE CONDITIONS) MAY BE AGGRAVATED BY EXPOSURE TO THIS MATERIAL.

INGESTION (SWALLOWING):

ASPIRATION HAZARD - THIS MATERIAL CAN ENTER LUNGS DURING SWALLOWING OR VOMITING AND CAUSE LUNG INFLAMMATION AND DAMAGE. INGESTION OF EXCESSIVE QUANTITIES OF THIS MATERIAL MAY CAUSE IRRITATION OF THE DIGESTIVE TRACT AND SIGNS OF NERVOUS SYSTEM DEPRESSION (E.G., HEADACHE, DROWSINESS, DIZZINESS, LOSS OF COORDINATION, AND FATIGUE).

COMMENTS:

GASOLINE IS A POSSIBLE CANCER HAZARD BASED ON TESTS IN LABORATORY ANIMALS. FOLLOW-UP STUDIES SUGGEST THAT THIS MAY BE A UNIQUE EFFECT IN MALE RATS. UNLEADED GASOLINE HAS BEEN IDENTIFIED AS A POSSIBLE CARCINOGEN BY IARC. BENZENE, A COMPONENT OF THIS PRODUCT, IS A KNOWN CANCER (LEUKEMIA) HAZARD. RESULTS OF TESTS IN HUMANS HAVE SHOWN THAT EXPOSURE TO BENZENE CAN CAUSE IRREVERSIBLE CHANGES IN THE GENETIC MATERIAL (DNA) OF A CELL. THE HUMAN HEALTH CONSEQUENCES OF THESE CHANGES IS NOT FULLY UNDERSTOOD. BENZENE HAS BEEN IDENTIFIED AS A CARCINOGEN BY IARC, NTP AND OSHA. THERE IS INSUFFICIENT EVIDENCE TO SHOW THAT GASOLINE POSES ANY HAZARD RELATED TO ITS LOW BENZENE CONTENT. PERSONS WITH PRE-EXISTING HEART DISORDERS MAY BE MORE SUSCEPTIBLE TO IRREGULAR HEARTBEATS (ARRHYTHMIAS) IF EXPOSED TO HIGH CONCENTRATIONS OF THIS MATERIAL (SEE SECTION II - NOTE TO PHYSICIANS).

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SECTION I - COMPONENTS	PERCENT	EXPOSURE LIMIT	UNITS	AGENCY	TYPE
XYLENES					
CAS #: 1330-20-7	1.0 - 14.0	100.000	ppm	ACGIH	TWA
		150.000	ppm	ACGIH	STEL
		100.000	ppm	MSHA	TWA
		100.000	ppm	OSHA	TWA
		150.000	ppm	OSHA	STEL
		200.000	ppm	CAL OSHA	EXCUR
		100.000	ppm	CAL OSHA	TWA-SKI
		300.000	ppm	CAL OSHA	CEIL-SK
N-HEXANE					
CAS #: 110-54-3		50.000	ppm	ACGIH	TWA
		500.000	ppm	MSHA	TWA
		50.000	ppm	OSHA	TWA
		50.000	ppm	CAL OSHA	TWA

OTHER COMPONENTS

--NONE--

THIS PRODUCT CONTAINS THE FOLLOWING CHEMICALS SUBJECT TO THE REPORTING REQUIREMENTS OF SARA 313 AND 40 CFR 372:

	CAS NUMBER	WEIGHT %
BENZENE	71-43-2	1-5
TOLUENE	108-88-3	1-9
XYLENES	1330-20-7	1-14
ETHYLBENZENE	100-41-4	1-5
METHYL TERT-BUTYL ETHER	1634-04-4	0-10
1,2,4-TRIMETHYLBENZENE	95-63-6	1-5

NOTE: GASOLINE IS A COMPLEX COMBINATION OF HYDROCARBONS, INCLUDING A SMALL QUANTITY OF BENZENE, TOLUENE, XYLENE AND N-HEXANE. THE IDENTITIES OF INGREDIENTS THAT ARE TRADE SECRETS ARE EXCLUDED FROM THIS LIST.

SECTION II - EMERGENCY AND FIRST AID PROCEDURES ***EMERGENCY***
Have physician call LOS ANGELES POISON
INFORMATION CENTER (24 hrs) (800) 356-3129

EYE CONTACT:

IF IRRITATION OR REDNESS DEVELOPS, MOVE VICTIM AWAY FROM EXPOSURE AND INTO FRESH AIR. FLUSH EYES WITH CLEAN WATER. IF SYMPTOMS PERSIST, SEEK MEDICAL ATTENTION.

SKIN CONTACT:

WIPE MATERIAL FROM SKIN AND REMOVE CONTAMINATED SHOES AND CLOTHING. CLEANSE AFFECTED AREA(S) THOROUGHLY BY WASHING WITH MILD SOAP AND WATER AND, IF NECESSARY, A WATERLESS SKIN CLEANSER. IF IRRITATION OR REDNESS DEVELOPS AND PERSISTS, SEEK MEDICAL ATTENTION.

INHALATION (BREATHING):

IF RESPIRATORY SYMPTOMS OR OTHER SYMPTOMS OF EXPOSURE DEVELOP, MOVE VICTIM AWAY FROM SOURCE OF EXPOSURE AND INTO FRESH AIR. IF SYMPTOMS PERSIST, SEEK IMMEDIATE MEDICAL ATTENTION. IF VICTIM IS NOT BREATHING, IMMEDIATELY BEGIN ARTIFICIAL RESPIRATION. IF BREATHING DIFFICULTIES DEVELOP, OXYGEN SHOULD BE ADMINISTERED BY QUALIFIED PERSONNEL. SEEK IMMEDIATE MEDICAL ATTENTION.

SECTION IV - SPECIAL PROTECTION INFORMATION

VENTILATION:

IF CURRENT VENTILATION PRACTICES ARE NOT ADEQUATE TO MAINTAIN AIRBORNE CONCENTRATIONS BELOW THE ESTABLISHED EXPOSURE LIMITS (SEE SECTION I), ADDITIONAL VENTILATION OR EXHAUST SYSTEMS MAY BE REQUIRED. WHERE EXPLOSIVE MIXTURES MAY BE PRESENT, ELECTRIC SYSTEMS SAFE FOR SUCH LOCATIONS MUST BE USED.

RESPIRATORY PROTECTION:

THE USE OF RESPIRATORY PROTECTION IS ADVISED WHEN CONCENTRATIONS EXCEED THE ESTABLISHED EXPOSURE LIMITS (SEE SECTION I). DEPENDING ON THE AIRBORNE CONCENTRATION USE A RESPIRATOR OR GAS MASK WITH APPROPRIATE CARTRIDGES AND CANNISTERS (NIOSH APPROVED, IF AVAILABLE) OR SUPPLIED AIR EQUIPMENT.

PROTECTIVE GLOVES:

THE USE OF GLOVES IMPERMEABLE TO THE SPECIFIC MATERIAL HANDLED IS ADVISED TO PREVENT SKIN CONTACT AND POSSIBLE IRRITATION.

EYE PROTECTION:

APPROVED EYE PROTECTION TO SAFEGUARD AGAINST POTENTIAL EYE CONTACT, IRRITATION OR INJURY IS RECOMMENDED.

OTHER PROTECTIVE EQUIPMENT:

IT IS SUGGESTED THAT A SOURCE OF CLEAN WATER BE AVAILABLE IN THE WORK AREA FOR FLUSHING EYES AND SKIN. IMPERVIOUS CLOTHING SHOULD BE WORN AS NEEDED.

SECTION V - REACTIVITY DATA

STABILITY:

STABLE UNDER NORMAL CONDITIONS OF STORAGE AND HANDLING.

CONDITIONS TO AVOID (STABILITY):

AVOID CONTACT OF LIQUID, FUMES, OR VAPORS WITH ANY SOURCE OF HEAT, SPARKS, OR FLAME.

INCOMPATIBILITY (MATERIALS TO AVOID):

STRONG OXIDIZING AGENTS SUCH AS CHLORINE, PERMANGANATES AND DICHROMATES MAY CAUSE OR EXPLOSION.

HAZARDOUS DECOMPOSITION PRODUCTS:

COMBUSTION MAY YIELD SIGNIFICANT AMOUNTS OF CARBON MONOXIDE AND SMALL AMOUNTS OF OXIDES OF SULFUR AND NITROGEN, BENZENE AND OTHER ORGANIC COMPOUNDS.

HAZARDOUS POLYMERIZATION:

WILL NOT OCCUR

POLYMERIZATION CONDITIONS TO AVOID:

NONE KNOWN

SECTION VI - SPILL AND LEAK PROCEDURES ***HIGHWAY OR RAILWAY SPILLS***
Call CHEMTREC (800) 424-9300 Cont. U.S.
(Collect) (202) 483-7616 from Alaska & Hawaii

PRECAUTIONS IN CASE OF RELEASE OR SPILL:

STAY UPWIND AND AWAY FROM SPILL/RELEASE. WEAR APPROPRIATE PROTECTIVE EQUIPMENT INCLUDING RESPIRATORY PROTECTION AS CONDITIONS WARRANT (SEE SECTION IV). DO NOT ENTER OR STAY IN AREA UNLESS MONITORING INDICATES THAT IT IS SAFE TO DO SO. ISOLATE HAZARD AREA AND LIMIT ENTRY TO EMERGENCY CREW. EXTREMELY FLAMMABLE. KEEP ALL SOURCES OF IGNITION AND HOT METAL SURFACES AWAY FROM SPILL/RELEASE. STOP SPILL/RELEASE IF IT CAN BE DONE WITHOUT RISK. SPILLED MATERIAL MAY BE ABSORBED INTO AN APPROPRIATE ABSORBENT MATERIAL. CONTACT FIRE AUTHORITIES AND APPROPRIATE FEDERAL, STATE OR LOCAL AGENCIES. PREVENT SPILLED MATERIAL FROM ENTERING SEWERS, STORM DRAINS, OTHER UNAUTHORIZED TREATMENT/DRAINAGE SYSTEMS AND NATURAL WATERWAYS. IF SPILL OF ANY AMOUNT IS MADE INTO OR UPON U.S. NAVIGABLE WATERS, THE CONTIGUOUS ZONE, OR ADJOINING SHORELINES, NOTIFY THE NATIONAL RESPONSE CENTER (PHONE NUMBER 800-424-8802).

WASTE DISPOSAL METHOD:

DISPOSE OF PRODUCT IN ACCORDANCE WITH LOCAL, COUNTY, STATE, AND FEDERAL REGULATIONS.

SECTION VII - STORAGE AND SPECIAL PRECAUTIONS

HANDLING AND STORAGE PRECAUTIONS:

STORE ONLY IN APPROVED CONTAINERS. KEEP CONTAINERS TIGHTLY CLOSED, OUT OF DIRECT SUNLIGHT, AND AWAY FROM ALL SOURCES OF IGNITION. KEEP AWAY FROM INCOMPATIBLE MATERIALS (SEE SECTION V). OUTDOOR OR DETACHED STORAGE IS PREFERRED. INDOOR STORAGE SHOULD BE IN A STANDARD FLAMMABLE LIQUID STORAGE ROOM. PROVIDE ADEQUATE VENTILATION AND POST AREA "NO SMOKING OR OPEN FLAME." BOND AND GROUND ALL EQUIPMENT WHEN TRANSFERRING FROM ONE VESSEL TO ANOTHER. KEEP WORK AREA FREE OF HOT METAL SURFACES AND OTHER SOURCES OF IGNITION. AVOID INHALATION OF VAPORS/MISTS/FUMES AND PERSONAL CONTACT WITH THE PRODUCT. WASH THOROUGHLY AFTER HANDLING. LAUNDER SATURATED CLOTHING BEFORE WEARING.

SECTION VIII - FIRE AND EXPLOSION HAZARD DATA

NFPA HAZARD CLASS	HEALTH HAZARD: FLAMMABILITY: REACTIVITY: OTHER:	HAZARD RANKING 0 - LEAST 1 - SLIGHT 2 - MODERATE 3 - HIGH 4 - EXTREME	FLASH POINT (TCC) -45 F
	2	0	
	3	1	
	0	2	
		3	
		4	

EXTINGUISHING MEDIA:

THE USE OF DRY CHEMICAL, FOAM OR CO2 IS RECOMMENDED.

UNUSUAL FIRE & EXPLOSION HAZARDS:

THIS MATERIAL IS EXTREMELY FLAMMABLE AND MAY BE IGNITED BY HEAT, SPARKS, FLAME OR OTHER SOURCES OF IGNITION (e.g. STATIC ELECTRICITY, PILOT LIGHTS OR MECHANICAL/ELECTRICAL EQUIPMENT). IF CONTAINER IS NOT PROPERLY COOLED, IT MAY EXPLODE IN HEAT OF A FIRE. VAPORS MAY TRAVEL CONSIDERABLE DISTANCES TO A SOURCE OF IGNITION WHERE THEY MAY IGNITE, FLASHBACK OR EXPLODE.

SPECIAL FIRE FIGHTING PROCEDURES:

THE USE OF A SELF-CONTAINED BREATHING APPARATUS (SCBA) IS RECOMMENDED FOR FIRE FIGHTERS. WATER SPRAY MAY BE USEFUL IN MINIMIZING VAPORS AND COOLING CONTAINERS EXPOSED TO HEAT AND FLAME. AVOID SPREADING BURNING LIQUID WITH WATER USED FOR COOLING PURPOSES. MOVE UNDAMAGED CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK.

SECTION IX - PHYSICAL DATA

***UNLESS OTHERWISE NOTED, VALUES ARE AT
20 C/68 F AND 760 mm Hg/1 atm.

<u>APPROX BOILING POINT</u>	(AIR - 1) <u>VAPOR DENSITY</u>	(N-BUTYL ACETATE - 1) <u>EVAPORATION RATE</u>	<u>% VOLATILE</u>
85-430 F / 29-221 C	>1	<1	100
<u>% SOLUBILITY IN WATER</u>			
NEGLECTIBLE			
<u>SPECIFIC GRAVITY</u>	<u>APPROX. BULK DENSITY (lb/gal)</u>		
0.75	6.5		
<u>APPEARANCE</u>			
RED LIQUID			
<u>ODOR</u>			
GASOLINE			

SECTION X - PRECAUTIONARY WARNING

DANGER! EXTREMELY FLAMMABLE. VAPORS MAY EXPLODE. HARMFUL OR FATAL IF SWALLOWED. VAPOR HARMFUL. ASPIRATION HAZARD IF SWALLOWED. CAN ENTER LUNGS AND CAUSE DAMAGE. POSSIBLE CANCER HAZARD BASED ON TESTS WITH LABORATORY ANIMALS. NO SMOKING. KEEP FROM HEAT, SPARKS OR FLAME INCLUDING PILOT LIGHTS, ELECTRIC MOTORS AND OTHER SOURCE OF IGNITION. VAPORS MAY BE IGNITED BY SPARK OR FLAME SOURCE MANY FEET AWAY. DO NOT OVERFILL TANK. USE ONLY WITH ADEQUATE VENTILATION. DO NOT BREATHE VAPOR OR MISKEE P FACE AWAY FROM NOZZLE AND CONTAINER OPENING. DO NOT GET IN EYES, ON SKIN OR CLOTHING. DO NOT TASTE OR SWALLOW. KEEP CONTAINER CLOSED. WASH THOROUGHLY AFTER HANDLING. NEVER SIPHON BY MOUTH. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, ON OR NEAR THIS CONTAINER. "EMPTY" CONTAINER RETAINS RESIDUE (LIQUID AND/OR VAPOR) AND MAY EXPLODE IN HEAT OF A FIRE. KEEP OUT OF REACH OF CHILDREN. FAILURE TO USE CAUTION MAY CAUSE SERIOUS INJURY OR ILLNESS. FIRST AID: DANGER - ASPIRATION HAZARD. IF SWALLOWED DO NOT INDUCE VOMITING. CALL A PHYSICIAN. IN CASE OF CONTACT FLUSH EYES OR SKIN WITH PLENTY OF WATER. NOTE TO PHYSICIANS: EPINEPHRINE AND CATECHOLAMINE SYMPATHOMIMETIC DRUGS SHOULD BE USED CAUTIOUSLY, IF AT ALL. IF USED, OBSERVE FOR DEVELOPMENT OF CARDIAC ARRHYTHMIAS.

SECTION XI - DOCUMENTARY INFORMATION

ISSUE DATE: 10/20/89 PRODUCT CODE NO. 00955
PREV. DATE: 04/25/89 PREV. PROD. CODE NO. N/A
MSDS NO: N/A PREV. MSDS NO: N/A

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Product Name: UNOCAL DIESEL #2
Product Code No: 01602

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Issue Date: 05/09/90
Status: FINAL

Responsible Party:

UNOCAL REFINING & MARKETING DIVISION
UNION OIL COMPANY OF CALIFORNIA
1201 WEST 5TH STREET
LOS ANGELES, CALIFORNIA 90017

CONTACT FOR FURTHER INFORMATION:
MSDS COORDINATOR 213-977-7589

Transportation Emergencies:

CHEMTREC
(800) 424-9300 Cont. U.S.
(202) 483-7616 (Collect)
from Alaska & Hawaii
Health Emergencies:
Call LOS ANGELES POISON
INFORMATION CENTER (24 hrs)
(800) 356-3129

PRODUCT IDENTIFICATION

PRODUCT NAME: UNOCAL DIESEL #2
SYNONYMS: UNION DIESEL #2
GENERIC NAME: MID-DISTILLATE
CHEMICAL FAMILY: PETROLEUM HYDROCARBON
DOT PROPER SHIPPING NAME: COMBUSTIBLE LIQUID, N.O.S. (MID DISTILLATE)
ID NUMBER: NA1993
DOT HAZARD CLASSIFICATION: COMBUSTIBLE LIQUID

PRECAUTIONARY WARNING

WARNING
MAY CAUSE SEVERE SKIN IRRITATION AFTER PROLONGED OR REPEATED CONTACT. BREATHING DIESEL EXHAUST MAY CAUSE LUNG CANCER. ASPIRATION HAZARD IF SWALLOWED. CAN ENTER LUNGS AND CAUSE DAMAGE. COMBUSTIBLE. AVOID PROLONGED OR REPEATED CONTACT WITH SKIN. AVOID BREATHING EXHAUST FUMES. DO NOT TASTE OR SWALLOW. WASH THOROUGHLY AFTER HANDLING. KEEP CONTAINER CLOSED. USE WITH ADEQUATE VENTILATION. KEEP AWAY FROM HEAT, SPARKS, FLAMES OR OTHER SOURCES OF IGNITION (e.g. STATIC ELECTRICITY, PILOT LIGHTS OR MECHANICAL/ELECTRICAL EQUIPMENT). DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, GRIND OR DRILL ON OR NEAR CONTAINER. "EMPTY" CONTAINER RETAINS RESIDUE (LIQUID AND/OR VAPOR) AND MAY EXPLODE IN HEAT OF A FIRE.

SECTION I - COMPONENTS	PERCENT	EXPOSURE LIMIT	UNITS	AGENCY	TYPE
HAZARDOUS COMPONENTS					
DIESEL OIL NO. 2 CAS #: 68476-34-6	>98	400.000	ppm	OSHA	TWA
BIPHENYL CAS #: 92-52-4	0.0 - 1.0	0.200	ppm	ACGIH	TWA
		0.200	ppm	MSHA	TWA
		0.200	ppm	OSHA	TWA
		0.200	ppm	CAL OSHA	TWA

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Status: F

SECTION I - COMPONENTS	PERCENT	EXPOSURE LIMIT	UNITS	AGENCY	
NAPHTHALENE					
CAS #: 91-20-3	0.0 - 1.0	10.000	ppm	ACGIH	TH
		15.000	ppm	ACGIH	ST
		10.000	ppm	MSHA	TH
		10.000	ppm	OSHA	TH
		15.000	ppm	OSHA	ST
		10.000	ppm	CAL OSHA	TH

OTHER COMPONENTS

--NONE--

THIS PRODUCT CONTAINS THE FOLLOWING CHEMICALS SUBJECT TO THE REPORTING REQUIREMENTS OF SARA 313 AND 40 CFR 372:

	CAS NUMBER	WEIGHT
BIPHENYL	92-52-4	0-1
NAPHTHALENE	91-20-3	0-1

SECTION II - EMERGENCY AND FIRST AID PROCEDURES

EMERGENCY

Have physician call LOS ANGELES POISON
INFORMATION CENTER (24 hrs) (800) 356-312

EYE CONTACT:

IF IRRITATION OR REDNESS DEVELOPS, MOVE VICTIM AWAY FROM EXPOSURE AND INTO FRESH AIR. FLUSH EYES WITH CLEAN WATER. IF SYMPTOMS PERSIST, SEEK MEDICAL ATTENTION.

SKIN CONTACT:

WIPE MATERIAL FROM SKIN, REMOVE CONTAMINATED SHOES AND CLOTHING, AND FLUSH AFFECTED AREA(S) WITH LARGE AMOUNTS OF WATER. IF SKIN SURFACE IS DAMAGED, APPLY A CLEAN DRESSING AND SEEK MEDICAL ATTENTION. IF SKIN SURFACE IS NOT DAMAGED, CLEANSE AFFECTED AREA(S) THOROUGHLY BY WASHING WITH MILD SOAP AND WATER AND, IF NECESSARY, A MILD SKIN CLEANSER. IF IRRITATION OR REDNESS DEVELOPS, SEEK MEDICAL ATTENTION.

INHALATION (BREATHING):

IF RESPIRATORY SYMPTOMS OR OTHER SYMPTOMS OF EXPOSURE DEVELOP, MOVE VICTIM AWAY FROM SOURCE OF EXPOSURE AND INTO FRESH AIR. IF SYMPTOMS PERSIST, SEEK IMMEDIATE MEDICAL ATTENTION. IF VICTIM IS NOT BREATHING, IMMEDIATELY BEGIN ARTIFICIAL RESPIRATION. IF BREATHING DIFFICULTIES DEVELOP, OXYGEN SHOULD BE ADMINISTERED BY QUALIFIED PERSONNEL. SEEK IMMEDIATE MEDICAL ATTENTION.

INGESTION (SWALLOWING):

ASPIRATION HAZARD: DO NOT INDUCE VOMITING OR GIVE ANYTHING BY MOUTH BECAUSE THE MATERIAL CAN ENTER THE LUNGS AND CAUSE SEVERE LUNG DAMAGE. IF VICTIM IS DROWSY OR UNCONSCIOUS, PLACE ON THE LEFT SIDE WITH THE HEAD DOWN. IF POSSIBLE, DO NOT LEAVE VICTIM UNATTENDED. SEEK MEDICAL ATTENTION.

SECTION III - HEALTH HAZARDS/ROUTES OF ENTRY

EYE CONTACT:

THIS MATERIAL MAY CAUSE MILD EYE IRRITATION. DIRECT CONTACT WITH THE LIQUID OR EXPOSURE TO VAPORS OR MISTS MAY CAUSE STINGING, TEARING AND REDNESS.

SKIN CONTACT:

THIS MATERIAL IS A SKIN IRRITANT. PROLONGED OR REPEATED CONTACT MAY CAUSE SKIN IRRITATION INCLUDING REDNESS AND BURNING, DRYING AND CRACKING OF THE SKIN, AND SKIN DAMAGE. NO HARMFUL EFFECTS ARE EXPECTED FROM SKIN ABSORPTION OF THIS MATERIAL.

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SECTION III - HEALTH HAZARDS/ROUTES OF ENTRY

PERSONS WITH PRE-EXISTING SKIN DISORDERS MAY BE MORE SUSCEPTIBLE TO THE EFFECTS OF THIS MATERIAL.

INHALATION (BREATHING):

WHILE THIS MATERIAL HAS A LOW DEGREE OF TOXICITY, BREATHING HIGH CONCENTRATIONS OF VAPORS OR MISTS MAY CAUSE IRRITATION OF THE NOSE AND THROAT AND SIGNS OF NERVOUS SYSTEM DEPRESSION (e.g. HEADACHE, DROWSINESS, DIZZINESS, LOSS OF COORDINATION, AND FATIGUE).

INGESTION (SWALLOWING):

WHILE THIS MATERIAL HAS A LOW DEGREE OF TOXICITY, INGESTION OF EXCESSIVE QUANTITIES MAY CAUSE IRRITATION OF THE DIGESTIVE TRACT AND SIGNS OF NERVOUS SYSTEM DEPRESSION (e.g. HEADACHE, DROWSINESS, DIZZINESS, LOSS OF COORDINATION, AND FATIGUE). ASPIRATION HAZARD - THIS MATERIAL CAN ENTER LUNGS DURING SWALLOWING OR VOMITING AND CAUSE LUNG INFLAMMATION AND DAMAGE.

COMMENTS:

DIESEL EXHAUST IS A PROBABLE HUMAN CANCER HAZARD, BUT IT HAS NOT BEEN IDENTIFIED AS A CARCINOGEN BY IARC, NTP OR OSHA.

SECTION IV - SPECIAL PROTECTION INFORMATION**VENTILATION:**

IF CURRENT VENTILATION PRACTICES ARE NOT ADEQUATE TO MAINTAIN AIRBORNE CONCENTRATIONS BELOW THE ESTABLISHED EXPOSURE LIMITS (SEE SECTION I), ADDITIONAL VENTILATION OR EXHAUST SYSTEMS MAY BE REQUIRED. WHERE EXPLOSIVE MIXTURES MAY BE PRESENT, ELECTRICAL SYSTEMS SAFE FOR SUCH LOCATIONS MUST BE USED.

RESPIRATORY PROTECTION:

THE USE OF RESPIRATORY PROTECTION IS ADVISED WHEN CONCENTRATIONS EXCEED THE ESTABLISHED EXPOSURE LIMITS (SEE SECTION I). DEPENDING ON THE AIRBORNE CONCENTRATION, USE A RESPIRATOR OR GAS MASK WITH APPROPRIATE CARTRIDGES AND CANNISTERS (NIOSH APPROVED, IF AVAILABLE) OR SUPPLIED AIR EQUIPMENT.

PROTECTIVE GLOVES:

THE USE OF GLOVES IMPERMEABLE TO THE SPECIFIC MATERIAL HANDLED IS ADVISED TO PREVENT SKIN CONTACT AND POSSIBLE IRRITATION.

EYE PROTECTION:

APPROVED EYE PROTECTION TO SAFEGUARD AGAINST POTENTIAL EYE CONTACT, IRRITATION OR INJURY IS RECOMMENDED.

OTHER PROTECTIVE EQUIPMENT:

IT IS SUGGESTED THAT A SOURCE OF CLEAN WATER BE AVAILABLE IN THE WORK AREA FOR FLUSHING EYES AND SKIN. IMPERVIOUS CLOTHING SHOULD BE WORN AS NEEDED.

SECTION V - REACTIVITY DATA**REACTIVITY:**

STABLE UNDER NORMAL CONDITIONS OF STORAGE AND HANDLING.

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SECTION V - REACTIVITY DATA

CONDITIONS AFFECTING REACTIVITY:

AVOID CONTACT WITH ANY SOURCE OF HEAT OR FLAME.

INCOMPATIBLE MATERIALS:

AVOID CONTACT WITH STRONG OXIDIZING AGENTS.

HAZARDOUS DECOMPOSITION PRODUCTS:

COMBUSTION MAY YIELD MAJOR AMOUNTS OF OXIDES OF CARBON AND MINOR AMOUNTS OF OXID SULFUR AND NITROGEN.

HAZARDOUS POLYMERIZATION:

WILL NOT OCCUR

POLYMERIZATION CONDITIONS TO AVOID:

NONE KNOWN

SECTION VI - SPILL AND LEAK PROCEDURES ***HIGHWAY OR RAILWAY SPILLS***
Call CHEMTREC (800) 424-9300 Cont. U.S.
(Collect) (202) 483-7616 from Alaska

PRECAUTIONS IN CASE OF RELEASE OR SPILL:

COMBUSTIBLE. KEEP ALL SOURCES OF IGNITION AWAY FROM SPILL/RELEASE. STAY UPWIND AWAY FROM SPILL/RELEASE. ISOLATE HAZARD AREA AND LIMIT ENTRY TO AUTHORIZED PERSONNEL. STOP SPILL/RELEASE IF IT CAN BE DONE WITHOUT RISK. WEAR APPROPRIATE PROTECTIVE EQUIPMENT INCLUDING RESPIRATORY PROTECTION AS CONDITIONS WARRANT (SEE SECTION V). PREVENT SPILLED MATERIAL FROM ENTERING SEWERS, STORM DRAINS, OTHER UNAUTHORIZED TREATMENT DRAINAGE SYSTEMS AND NATURAL WATERWAYS. DIKE FAR AHEAD OF SPILL FOR RECOVERY OR DISPOSAL. SPILLED MATERIAL MAY BE ABSORBED INTO AN APPROPRIATE ADSORBENT MATERIAL. NOTIFY FIRE AUTHORITIES AND APPROPRIATE FEDERAL, STATE AND LOCAL AGENCIES IMMEDIATE CLEANUP OF ANY SPILL IS RECOMMENDED. IF SPILL OF ANY AMOUNT IS MADE UPON U.S. NAVIGABLE WATERS, THE CONTIGUOUS ZONE, OR ADJOINING SHORELINES, NOTIFY THE NATIONAL RESPONSE CENTER (PHONE NUMBER 800-424-8802).

WASTE DISPOSAL METHOD:

DISPOSE OF PRODUCT IN ACCORDANCE WITH LOCAL, COUNTY, STATE, AND FEDERAL REGULATIONS.

SECTION VII - STORAGE AND SPECIAL PRECAUTIONS

HANDLING AND STORAGE PRECAUTIONS:

KEEP CONTAINER(S) TIGHTLY CLOSED. USE AND STORE THIS MATERIAL IN COOL, DRY, WELL VENTILATED AREAS AWAY FROM HEAT AND ALL SOURCES OF IGNITION. POST AREA "NO SMOKING, NO OPEN FLAME." BOND AND GROUND ALL EQUIPMENT WHEN TRANSFERRING FROM ONE VESSEL TO ANOTHER. STORE ONLY IN APPROVED CONTAINERS. KEEP AWAY FROM ANY INCOMPATIBLE MATERIALS (SEE SECTION V). PROTECT CONTAINER(S) AGAINST PHYSICAL DAMAGE. TI EXPLOSION-PROOF EQUIPMENT IS RECOMMENDED AND MAY BE REQUIRED (SEE APPROPRIATE CODES). DO NOT ENTER CONFINED SPACES SUCH AS TANKS OR PITS WITHOUT FOLLOWING ENTRY PROCEDURES SUCH AS ASTM D-4276. OUTDOOR OR DETACHED STORAGE IS PREFERRED. INDOOR STORAGE SHOULD MEET OSHA STANDARDS AND APPROPRIATE FIRE CODES. THE USE OF RESPIRATORY PROTECTION IS ADVISED WHEN CONCENTRATIONS EXCEED ANY ESTABLISHED LIMITS (SEE SECTIONS I AND IV). WASH THOROUGHLY AFTER HANDLING. DO NOT WEAR CONTAMINATED CLOTHING OR SHOES. USE GOOD PERSONAL HYGIENE PRACTICE. "EMPTY" CONTAINERS RETAIN RESIDUE (LIQUID AND/OR VAPOR) AND CAN BE DANGEROUS. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO FLAME, SPARKS OR OTHER SOURCES OF IGNITION; THEY MAY EXPLODE AND CAUSE INJURY OR DEATH. "EMPTY" DRUMS SHOULD BE COMPLETELY DRAINED, PROPERLY BUNGED AND PROTECTED.

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SECTION VII - STORAGE AND SPECIAL PRECAUTIONS

SHIPPED TO THE SUPPLIER OR A DRUM RECONDITIONER. ALL OTHER CONTAINERS SHOULD BE DISPOSED OF IN AN ENVIRONMENTALLY SAFE MANNER AND IN ACCORDANCE WITH GOVERNMENTAL REGULATIONS. BEFORE WORKING ON OR IN TANKS WHICH CONTAIN OR HAVE CONTAINED THIS PRODUCT, REFER TO OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION REGULATIONS, ANSI Z49.1, AND OTHER GOVERNMENTAL AND INDUSTRIAL REFERENCES PERTAINING TO CLEANING, REPAIRING, WELDING, OR OTHER CONTEMPLATED OPERATIONS.

SECTION VIII - FIRE AND EXPLOSION HAZARD DATA

NFPA HAZARD CLASS	HEALTH HAZARD:	0	HAZARD RANKING	
	FLAMMABILITY:	2	0 = LEAST	
	REACTIVITY:	0	1 = SLIGHT	FLASH POINT
	OTHER:		2 = MODERATE	140-190 F (PMCC)
			3 = HIGH	60-87 C
			4 = EXTREME	

EXTINGUISHING MEDIA:

DRY CHEMICAL, CARBON DIOXIDE, HALON, FOAM OR WATER SPRAY IS RECOMMENDED.

UNUSUAL FIRE & EXPLOSION HAZARDS:

THIS MATERIAL IS COMBUSTIBLE AND MAY BE IGNITED BY HEAT, SPARKS, FLAME OR OTHER SOURCES OF IGNITION (e.g. STATIC ELECTRICITY, PILOT LIGHTS, MECHANICAL/ELECTRICAL EQUIPMENT). VAPORS MAY TRAVEL CONSIDERABLE DISTANCES TO A SOURCE OF IGNITION WHERE THEY MAY IGNITE, FLASHBACK OR EXPLODE. VAPOR/AIR EXPLOSION HAZARD INDOORS/OUTDOORS OR IN SEWERS. VAPORS ARE HEAVIER THAN AIR AND MAY ACCUMULATE IN LOW AREAS. IF CONTAINER IS NOT PROPERLY COOLED, IT MAY EXPLODE IN THE HEAT OF A FIRE.

SPECIAL FIRE FIGHTING PROCEDURES:

WEAR APPROPRIATE PROTECTIVE EQUIPMENT INCLUDING RESPIRATORY PROTECTION AS CONDITIONS WARRANT (SEE SECTION IV). STOP SPILL/RELEASE IF IT CAN BE DONE WITHOUT RISK. MOVE UNDAMAGED CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. WATER SPRAY MAY BE USEFUL IN MINIMIZING OR DISPERSING VAPORS AND COOLING EQUIPMENT EXPOSED TO HEAT AND FLAME. AVOID SPREADING BURNING LIQUID WITH WATER USED FOR COOLING PURPOSES.

SECTION IX - PHYSICAL DATA

***UNLESS OTHERWISE NOTED, VALUES ARE AT
20 C/68 F AND 760 mm Hg/1 atm.

<u>APPROX BOILING POINT</u>	(AIR = 1) <u>VAPOR DENSITY</u>	(N-BUTYL ACETATE = 1) <u>EVAPORATION RATE</u>	<u>% VOLATILE</u>
490-700 F / 232-271 C	>1	<1	98

% SOLUBILITY IN WATER

<0.1

SPECIFIC GRAVITY

0.85

APPROX. BULK DENSITY (LB/GAL)

7.0

APPEARANCE

CLEAR TO YELLOW LIQUID

ODOR

CHARACTERISTIC PETROLEUM

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SECTION X - DOCUMENTARY INFORMATION

ISSUE DATE: 05/09/90 PRODUCT CODE NO. 01602
PREV. DATE: 12/18/89 PREV. PROD. CODE NO. N/A
MSDS NO: N/A PREV. MSDS NO: N/A

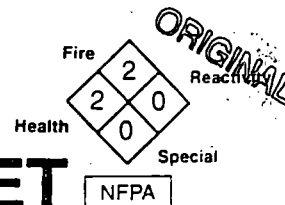
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WD-40®



MATERIAL SAFETY DATA SHEET

I. PRODUCT IDENTIFICATION

Manufacturer: WD-40 Company
Address: 1061 Cudahy Place (92110)
P.O. Box 80607
San Diego, California
92138-9021

Emergency / Information
Telephone: (619) 275-1400
Chemical Name: Organic Mixture
Trade Name: WD-40 Bulk Liquid

II. HAZARDOUS INGREDIENTS

Chemical Name	CAS Number	%	Exposure Limit ACGIH/OSHA
Aliphatic Petroleum Distillates	8052-41-3	70	100 ppm (PEL)
Petroleum Base Oil	64742-65-0	20	5 mg/M ³ (TWA)
Corrosion Inhibitor	Proprietary Mixture	< 10	5 mg/M ³ (TWA)
Wetting Agent	Proprietary Mixture	< 5	500 ppm (PEL)
Fragrance	Proprietary Mixture	< 5	NDA

III. PHYSICAL DATA

Boiling Point:	300°F (minimum)	Evaporation Rate:	Not determined
Vapor Density (air = 1):	Greater than 1	Vapor Pressure:	Not determined
Solubility in Water:	Insoluble	Appearance:	Cloudy light amber
Specific Gravity (H ₂ O = 1):	.800 @ 70°F	Odor:	Characteristic odor
Percent Volatile (volume):	74%	VOC:	576 grams per liter

IV. FIRE AND EXPLOSION

Flash Point:	Tag Open Cup 110°F (minimum)
Flammable Limits:	(solvent portion) [Lel] 1.0% [Uel] 6.0%
Extinguishing Media:	CO ₂ , Dry Chemical, Foam
Special Fire Fighting Procedures:	None
Unusual Fire and Explosion Hazards:	None

V. HEALTH HAZARD / ROUTE(S) OF ENTRY

Threshold Limit Value

Aliphatic Petroleum Distillates (Stoddard solvent) lowest TLV (ACGIH 100 ppm.)

Symptoms of Overexposure

Inhalation (Breathing): May cause anesthesia, headache, dizziness, nausea and upper respiratory irritation.

Skin Contact: May cause drying of skin and or irritation.

Eye Contact: May cause irritation, tearing and redness.

Ingestion (Swallowed): May cause irritation, nausea, vomiting and diarrhea.

First Aid Emergency Procedures

Ingestion (Swallowed): Do not induce vomiting, seek medical attention.

Eye Contact: Immediately flush eyes with large amounts of water for 15 minutes.

Skin Contact: Wash with soap and water.

Inhalation (Breathing): Remove to fresh air. Give artificial respiration if necessary. If breathing is difficult, give oxygen.

DANGER!

Aspiration Hazard: If swallowed can enter lungs and may cause chemical pneumonitis. Do not induce vomiting. Call Physician immediately.

Suspected Cancer Agent

Yes _____ No ☒ X

The components in this mixture have been found to be noncarcinogenic by NTP, IARC and OSHA.

VI. REACTIVITY DATA

Stability:	Stable <u>X</u>	Unstable _____
Conditions to avoid:	NA	
Incompatibility:	Strong oxidizing materials	
Hazardous decomposition products:	Thermal decomposition may yield carbon monoxide and/or carbon dioxide.	
Hazardous polymerization:	May occur _____	Will not occur <u>X</u>

VII. SPILL OR LEAK PROCEDURES

Spill Response Procedures

Absorb small quantities with sand, earth, sawdust. Large quantities pump into tank.

Waste Disposal Method

Incinerate liquid, bury saturated absorbent in land fill. Dispose of in accordance with local, state and federal regulations.

VIII. SPECIAL HANDLING INFORMATION


Ventilation:	Sufficient to keep solvent vapor less than TLV.
Respiratory Protection:	Advised when concentrations exceed TLV.
Protective Gloves:	Advised to prevent possible skin irritation.
Eye Protection:	Approved eye protection to safeguard against potential eye contact, irritation or injury.
Other Protective Equipment:	None required.

IX. SPECIAL PRECAUTIONS

Keep from open flame, do not take internally. Avoid excessive inhalation of spray particles. Keep from children.

X. TRANSPORTATION DATA

Domestic Surface	
Description:	Petroleum Distillate Mixture
Hazard Class:	Combustible Liquid
ID No.:	UN 1268
Label Required:	NONE. for containers less than 100 Gallons
Domestic Air	
Description:	Petroleum Distillate Mixture
Hazard Class:	Combustible Liquid
Label Required:	NONE. for containers less than 110 Gallons

SIGNATURE: R. Miles 

TITLE: Technical Director

REVISION DATE: January 1989

SUPERSEDES: April 1986

NA = Not applicable

NDA = No data available

< = Less than

> = More than

Material Name
Quaker State Super Blend 10W-30 Motor Oil

Page : 1
Date Prepared: 11/02/1994
MSDS No.: QS-CO-17

ORIGINAL

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Chemical Name: Petroleum distillate mixture
Internal Part No.: Order Nos. 01206 (case/4x4 qt); 01208 (5 gallon);
01210 (55 gallon); 01219 bulk

Manufacturer Information

Quaker State Corporation
P.O. Box 989
Oil City, Pennsylvania 16301
----PHONE #: (814)676-7676
EMERGENCY #: (814)676-7676
Mfg. Part #NA

Supplier Information

None
----PHONE #:
EMERGENCY #:

Sup. Part #NA

Synonyms: Motor Oil

Section 2 - COMPOSITION / INFORMATION ON INGREDIENTS

CAS #	Components	% Vol
64742-65-0	Petroleum Distillates, Solvent Dewaxed Heavy Paraffinic	0-80
64742-54-7	Petroleum Distillates, Hydrotreated Heavy Paraffinic	0-80
64742-62-7	Residual Oils (petroleum), Solvent Dewaxed	2-6
84605-20-9	Polyolefin alkene amine	1-5
68649-42-3	Zinc C1-C14 alkyldithiophosphate	1-2
68648-89-5	Styrene-ethylene/propylene block polymer	3-8
127883-08-3	Ethylene/propylene copolymer	0-2

Component Information/Information on Non-Hazardous Components

This product is not considered a hazardous product under 29 CFR 1910.1200 (Hazard Communication). All mineral oils used in this product have been severely hydrotreated and/or solvent refined. Exact composition of this product will vary with availability of materials. All ingredients listed above may not always be included in final product.

Section 3 - HAZARDS IDENTIFICATION

Emergency Overview

This product is a viscous amber liquid. It will burn at elevated temperatures (above 400 F). Addition of water or foam to the fire may cause frothing. Use dry chemical or carbon dioxide for small fires, water spray or foam for large fires.

Continued on next page...

MATERIAL SAFETY
DATA SHEET

ORIGINAL

Material Name
Quaker State Super Blend 10W-30 Motor Oil

Page : 2
Date Prepared: 11/02/1994
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Label Information

WARNING: Continuous contact with used motor oil has caused skin cancer in animal tests. Avoid prolonged contact. Wash skin with soap and water. Launder or discard soiled clothes.

Potential Health Effects

Eyes

This product may cause irritation to the eyes.

Skin

Prolonged or repeated contact with skin may cause mild irritation and possibly dermatitis. Symptoms may include redness, edema, drying, defatting and cracking of the skin.

Ingestion

Low toxicity. Swallowing may cause stomach cramps and diarrhea. Pulmonary aspiration hazard if swallowed.

Inhalation

Negligible hazard at room temperature (up to 95 degrees F). High temperatures or mechanical action may form mists or fumes. Inhalation of oil mists or fumes can cause irritation of the nose, throat and upper respiratory tract.

Section 4 - FIRST AID MEASURES

Eyes

Flush eyes with large amounts of water for 15 minutes. If eyes become inflamed, seek medical advice.

Skin

Remove contaminated clothing. Wash affected area with mild soap and water. Launder contaminated clothing before reuse. If leather articles become saturated they should be discarded.

Ingestion

Do not induce vomiting unless instructed to do so by a physician. Call your local poison control center or get medical attention.

Inhalation

Remove to fresh air. If not breathing, give mouth to mouth resuscitation. If breathing is difficult, give oxygen. Call a physician.

Notes to Physician

This material, if aspirated into the lungs, may cause chemical pneumonitis; treat the affected person appropriately.

Section 5 - FIRE FIGHTING MEASURES

Flash Point

400 deg F (204 deg C)

Method Used

Cleveland Open Cup

UFL

Not determined

LFL

Not determined

Auto Ignition

Not determined

Flammability Classification

IIIB

Rate of Burning

Not determined

Continued on next page...

Material Name
Quaker State Super Blend 10W-30 Motor Oil

Page : 3
Date Prepared: 11/02/1994
MSDS No.: QS-CO-17

ORIGINAL

General Fire Hazards

This product is combustible at high temperatures.

Hazardous Combustion Products

Carbon dioxide, carbon monoxide, aldehydes, ketones, oxides of sulfur, nitrogen, sodium, calcium, magnesium, phosphorus and zinc, and other hydrocarbon fractions.

Extinguishing Media

Dry chemical or carbon dioxide for small fires. Water spray or foam for large fires.

Fire Fighting Equipment/Instructions

Wear full set of protective equipment including chemical goggles and gloves. Use water spray to cool fire-exposed containers and as a protective screen. Do not point solid water stream directly into burning oil to avoid spreading.

NFPA Ratings: Fire: 1 Health: 1 Reactivity: 0 Other:

HMIS Ratings: Fire: 1 Health: 1 Reactivity: 0
Personal Protection: gloves, glasses/face shield

Section 6 - ACCIDENTAL RELEASE MEASURES
--

Containment Procedures

Eliminate all sources of ignition or flammables that may come into contact with a spill of this material. Stop the flow of material, if this is without risk.

Clean-Up Procedures

Wear appropriate protective equipment and clothing during clean-up. Absorb with inert absorbent such as dry clay, sand or diatomaceous earth, commercial sorbents, or recover using pumps. Scoop up used absorbent into drums. Do not allow the spilled product to enter public drainage systems or open water courses. Surfaces may become slippery after spillage.

Evacuation Procedures

Persons not wearing protective equipment should be excluded from area of spill until clean-up has been completed.

Special Instructions

Remove soiled clothing and launder before reuse. Avoid skin contact and inhalation of vapors during disposal of spills.

Section 7 - HANDLING AND STORAGE

Procedures for Handling

Avoid getting this material into contact with your skin and eyes. Avoid breathing fumes if this product is used at high temperatures. Avoid the generation of oil mists. Wash hands after handling and before eating. Launder work clothes frequently.

Recommended Storage Methods

Keep the container tightly closed and in a cool, well-ventilated place. Do not store this material in open or unlabeled containers. Store away from strong oxidizers. Empty containers may retain product residue including flammable or explosive vapors. Do not cut, drill, grind, or weld near full, partially full, or empty product containers.

Continued on next page...

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Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines

A. General Product Information

If oil mists are generated, observe the OSHA exposure limit of 5 mg/m3. Protect from skin and eye contact.

B. Component Exposure Limits

No ACGIH, NIOSH or OSHA exposure guidelines listed for this product's components.

Engineering Ctrl.: Use general ventilation. Use in a well-ventilated area.

PERSONAL PROTECTIVE EQUIPMENT

Eye/Face: Wear safety glasses; chemical goggles (if splashing is possible).

Skin: Use impervious gloves for prolonged contact or any contact with used oil. The use of neoprene gloves is recommended.

Respiratory: Normally not necessary. If mist is generated (heating, spraying) and engineering controls are not sufficient, wear approved organic vapor respirator suitable for oil mist.

General: Use good hygiene when handling petroleum product.

Section 9 - PHYSICAL & CHEMICAL PROPERTIES

Appearance	: Light amber	Odor	: Mild hydrocarbon
Physical State	: Liquid	pH	: Not available
Vapor Pressure	: Negligible	Vapor Density	: Not determined
Boiling Point	: Not determined	Freezing Point	: Not determined
Melting Point	: Not determined	Solubility (H2O)	: Negligible in water
Specific Gravity	: 0.87 to 0.89	Particle Size	: Not available
Softening Point	: Not determined	Evaporation Rate	: Not determined
Viscosity	: approx. 366 SUS @ 100 F	Bulk Density	: Not determined
Percent Volatile	: Negligible	Molecular Weight	: Mixture
Additional Properties	None		

Section 10 - CHEMICAL STABILITY & REACTIVITY INFORMATION

Chemical Stability: Stable

Conditions to Avoid: Avoid excessive heat and all sources of ignition.

Incompatibility

Strong oxidizing agents (peroxides, chlorine, strong acids).

Hazardous Decomposition Products

At thermal decomposition temperatures carbon dioxide, carbon monoxide, fumes, smoke, aldehydes, ketones, oxides of sulfur, nitrogen, sodium, calcium, magnesium, phosphorus, and zinc, and various hydrocarbons.

Hazardous Polymerization

Hazardous polymerization will not occur.

Continued on next page...

ORIGINAL

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Section 11 - TOXICOLOGICAL INFORMATION

Acute Toxicity/Target Organ Information

A. General Product/Component Information

Based on similar products the LD50 is expected to be greater than 5,000 mg/kg. Product has the ability to cause oil acne on the skin and fibrosis in the lung.

B. Component LD50/LC50

Epidemiology

No data available for product.

Carcinogenicity

A. General Product/Component Information

No data available on the product as a whole. Note that USED oils tend to contain higher amounts of the cancer-causing aromatics, which have been linked to scrotal and lung cancer in humans.

B. Component Carcinogenicity Listings

None of this product's components are listed by ACGIH, IARC, NIOSH, NTP or OSHA.

Teratogenicity/Reproductive Effects

No data available for the product as a whole. Review of information on components indicates no components at greater than 1.0% have teratogenic effects.

Neurotoxicity

No data available on this product as a whole. Excessive exposure to the oil mist and vapors may cause respiratory tract irritation.

Mutagenicity

No data available on this product as a whole. Review of information on components indicates no components at greater than 1.0 % have mutagenic effects.

Other Information

Persons with skin or respiratory conditions may be more sensitive to product.

Section 12 - ECOLOGICAL INFORMATION

Ecotoxicity

No information is available on ecotoxicity of this product. Keep product out of sewers and waterways.

Environmental Fate

No information is available.

Section 13 - DISPOSAL CONSIDERATIONS

US EPA Waste Number & Descriptions

A. General Product Information

Product as shipped does not meet the definition or characteristics of a hazardous waste. User must test waste using methods described in 40 CFR Part 261 to determine if it meets applicable definitions of hazardous wastes.

Continued on next page...

Material Name
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Date Prepared: 11/02/1994
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B. Component Waste Numbers

No EPA Waste Numbers are applicable for this product's components.

Disposal Instructions

Used oil can be returned to a collection center or provided to a licensed recycler. All wastes must be handled in accordance with local, state and federal regulations.

Section 14 - TRANSPORTATION INFORMATION

DOT Information

Shipping Name: Not regulated as a hazardous material

Hazard Class: None

UN/NA #: None

Packing Group: None

International Transportation Regulations

Not regulated as dangerous goods.

Section 15 - REGULATORY INFORMATION

US Federal Regulations

A. General Product Information

All components of this product are listed on the U.S. EPA TSCA Inventory.

B. Component Information

None of this product's components are listed under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) or CERCLA (40 CFR 302.4).

State Regulations

A. General Product Information

No components require labeling under California Proposition 65.

B. Component Information

None of this product's components are listed on the state lists from CA, FL, MA, MN, NJ, or PA.

Other Regulations

A. General Product Information

This product is not considered a controlled product under the Canadian Controlled Products Act.

B. Component Information

None of this product's components are listed on the Canadian Controlled Product Ingredient Disclosure List.

Section 16 - OTHER INFORMATION

Other Information

This information is, to the best of Quaker State Corporation's knowledge and belief, accurate and reliable. However, no representation, warranty, or guarantee is made to its accuracy, reliability, or completeness. It is the user's responsibility to satisfy himself as to the suitability and completeness of such information for his own particular use.

Preparation Information: last revised 11/02/94

Key/Legend

NA = Not Applicable; ND = Not Determined; Y = Yes; N = No

Continued on next page...

MATERIAL SAFETY
DATA SHEET

Material Name

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Date Prepared: 11/02/1994

MSDS No.: QS-CO-17

ORIGINAL

Contact Person: D. W. Cralley - Corporate
Manager, Health and Safety

Phone: (814) 676-7676

End of MSDS #QS-CO-17



Material Safety Data Sheet

LIQUID AIR CORPORATION INDUSTRIAL GASES DIVISION One California Plaza, Suite 350 2121 N. California Blvd. Walnut Creek, California 94596	PRODUCT NAME Oxygen		CAS NUMBER 7782-44-7
	TELEPHONE (415) 977-6500 EMERGENCY RESPONSE INFORMATION ON PAGE 2		
	TRADE NAME AND SYNONYMS Oxygen		
	CHEMICAL NAME AND SYNONYMS Oxygen		
ISSUE DATE OCTOBER 1, 1985 AND REVISIONS CORPORATE SAFETY DEPT.	FORMULA O ₂	MOLECULAR WEIGHT 31.999	CHEMICAL FAMILY Oxidizer

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT None established (ACGIH, 1984-85). Oxygen is the "vital element" in the atmosphere in which we live and breathe (approximately 21 molar % of the atmosphere).

SYMPTOMS OF EXPOSURE

Breathing high concentrations (greater than 75 molar percent) causes symptoms of hyperoxia which include cramps, nausea, dizziness, hypothermia, ambylopia, respiratory difficulties, bradycardia, fainting spells and convulsions capable of leading to death. For additional data on hyperoxia as it relates to oxygen pressure and exposure duration, refer to L'Air Liquide's Encyclopedie des Gaz.

TOXICOLOGICAL PROPERTIES

The property is that of hyperoxia which leads to pneumonia. Concentrations between 25 and 75 molar percent present a risk of inflammation of organic matter in the body.

Listed as Carcinogen or Potential Carcinogen	National Toxicology Program	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	I.A.R.C. Monographs	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	OSHA	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
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RECOMMENDED FIRST AID TREATMENT

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO OXYGEN. RESCUE PERSONNEL SHOULD BE COGNIZANT OF EXTREME FIRE HAZARD ASSOCIATED WITH OXYGEN-RICH ATMOSPHERES.

Conscious persons should be assisted to an uncontaminated area and breathe fresh air. They should be kept warm and quiet. The physician should be informed that the victim is experiencing (has experienced) hyperoxia.

Unconscious persons should be moved to an uncontaminated area and given assisted respiration. When breathing has been restored, treatment should be as above. Continued treatment should be symptomatic and supportive.

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

Oxygen vigorously accelerates combustion. Contact with all flammable materials should be avoided. Some materials which are not flammable in air will burn in pure oxygen or oxygen-enriched atmospheres.

PHYSICAL DATA

BOILING POINT -297.35°F (-182.97°C)	LIQUID DENSITY AT BOILING POINT 71.23 lb/ft ³ (1141 kg/m ³)
VAPOR PRESSURE @ 70°F (21.1°C) above the critical temp. of -181.433°F (-118.574°C)	GAS DENSITY AT 70°F 1 atm .0828 lb/ft ³ (1.326 kg/m ³)
SOLUBILITY IN WATER @ 68°F (20°C) Bunsen coefficient = .0310	FREEZING POINT -361.838°F (-118.574°C)
APPEARANCE AND ODOR Colorless, odorless and tasteless gas. Specific gravity @ 70F (Air=1.0) is 1.11.	

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED) N/A	AUTO IGNITION TEMPERATURE N/A	FLAMMABLE LIMITS % BY VOLUME N/A
EXTINGUISHING MEDIA Copious quantities of water for fires with oxygen as the oxidizer.		ELECTRICAL CLASSIFICATION Nonhazardous
SPECIAL FIRE FIGHTING PROCEDURES If possible, stop the flow of oxygen which is supporting the fire.		
UNUSUAL FIRE AND EXPLOSION HAZARDS Vigorously accelerates combustion.		

REACTIVITY DATA

STABILITY Unstable		CONDITIONS TO AVOID
Stable	X	
INCOMPATIBILITY (Materials to avoid) All flammable materials		
HAZARDOUS DECOMPOSITION PRODUCTS None		
HAZARDOUS POLYMERIZATION May Occur		CONDITIONS TO AVOID
Will Not Occur	X	

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is in container or container valve, contact the closest Liquid Air Corporation location.
WASTE DISPOSAL METHOD Do not attempt to dispose of residual or unused quantities. Return in the shipping container properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place to Liquid Air Corporation for proper disposal. For emergency disposal, contact the closest Liquid Air Corporation location.

EMERGENCY RESPONSE INFORMATION

IN CASE OF EMERGENCY INVOLVING THIS MATERIAL, CALL DAY OR NIGHT (800) 231-1366
OR CALL CHEMTREC AT (800) 424-9300



LIQUID AIR CORPORATION
INDUSTRIAL GASES DIVISION

ORIGINAL

ADDITIONAL DATA

SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type) <div style="text-align: center; margin-top: 5px;">N/A</div>		
VENTILATION To prevent accumulation above 25 molar percent.	LOCAL EXHAUST To prevent accumulation above 25 molar percent. MECHANICAL (Gen.)	SPECIAL OTHER
PROTECTIVE GLOVES As required; any material		
EYE PROTECTION Safety goggles or glasses		
OTHER PROTECTIVE EQUIPMENT Safety shoes, safety shower		

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION	
DOT Shipping Name: Oxygen or Oxygen, compressed DOT Shipping Label: Oxidizer	DOT Hazard Class: Nonflammable gas I.D. No.: UN 1072

SPECIAL HANDLING RECOMMENDATIONS Use only in well-ventilated areas. Valve protection caps and valve outlet threaded plugs must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder. <div style="text-align: center; font-size: small; margin-top: 20px;"> For additional handling recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1. </div>

SPECIAL STORAGE RECOMMENDATIONS Protect cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavily trafficked areas and emergency exits and away from full or empty stored cylinders which contain flammable products. Do not allow the temperature where cylinders are stored to exceed 130F (54C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time. <div style="text-align: center; font-size: small; margin-top: 20px;"> For additional storage recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1. </div>
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SPECIAL PACKAGING RECOMMENDATIONS Carbon steels and low alloy steels are acceptable for use at lower pressures. For high pressure applications use stainless steels, copper and its alloys, nickel and its alloys, brass, bronze, silicon alloys, Monel [®] , Inconel [®] or beryllium. Lead and silver or lead and tin alloys are good gasketing materials. Teflon [®] and Kel-F [®] are the preferred nonmetal gaskets. Special Note: It should be recognized that the ignition temperature of metals and nonmetals in pure oxygen service decreases with increasing oxygen pressure. For additional information refer to L'Air Liquide's Encyclopedie des Gaz.
--

OTHER RECOMMENDATIONS OR PRECAUTIONS Oxygen should not be used as a substitute for compressed air in pneumatic equipment since this type generally contains flammable lubricants. Equipment to contain oxygen must be "cleaned for oxygen service." See Compressed Gas Association Pamphlet G-4.1. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR).

*Various Government agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage or use of this product which may not be contained herein. The customer or user of this product should be familiar with these regulations.



LIQUID AIR CORPORATION
INDUSTRIAL GASES DIVISION

ORIGINAL

Material Safety Data Sheet

LIQUID AIR CORPORATION INDUSTRIAL GASES DIVISION One California Plaza, Suite 350 2121 N. California Blvd. Walnut Creek, California 94596	PRODUCT NAME Acetylene	CAS Number: 74-86-2
	TELEPHONE (415) 977-6500 EMERGENCY RESPONSE INFORMATION ON PAGE 2	
	TRADE NAME AND SYNONYMS Acetylene, Ethyne	
ISSUE DATE OCTOBER 1, 1985 AND REVISIONS CORPORATE SAFETY DEPT.	CHEMICAL NAME AND SYNONYMS Acetylene, Ethyne	CHEMICAL FAMILY Alkyne
	FORMULA C ₂ H ₂ MOLECULAR WEIGHT 26.0	

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT Acetylene is defined as a simple asphyxiant. Oxygen levels should be maintained at greater than 18 molar percent at normal atmospheric pressure which is equivalent to a partial pressure of 135 mm Hg. (ACGIH, 1984-85)

SYMPTOMS OF EXPOSURE

Inhalation: Low concentrations (10-20% in air) cause symptoms similar to that of being intoxicated. Higher concentrations so as to exclude an adequate supply of oxygen to the lungs cause unconsciousness.

TOXICOLOGICAL PROPERTIES

As a narcotic gas or intoxicant causes hypercapnia (an excessive amount of carbon dioxide in the blood). Repeated exposures to tolerable levels has not shown deleterious effects. The major property is the exclusion of an adequate supply of oxygen to the lungs.

Listed as Carcinogen
or Potential Carcinogen

National Toxicology
Program Yes ☐
No ☒

I.A.R.C.
Monographs Yes ☐
No ☒

OSHA Yes ☐
No ☒

RECOMMENDED FIRST AID TREATMENT

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO ACETYLENE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS AND BE COGNIZANT OF EXTREME FIRE AND EXPLOSION HAZARD.

Inhalation: Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given mouth-to-mouth resuscitation and supplemental oxygen. Medical assistance should be sought immediately.

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

Flammable over an extremely wide range in air. Explosive reactions may occur on ignition. Reacts explosively with halogens and halogenated compounds.

PHYSICAL DATA

BOILING POINT Sublimation point = -118.8°F (-83.8°C)	LIQUID DENSITY AT BOILING POINT See last page
VAPOR PRESSURE 645 psia (4450 kPa) @ 70°F (21.1°C)	GAS DENSITY AT 70°F 1 atm @ 60°F (15.6°C) = .0691 lb/ft ³ (1.107 kg/m ³)
SOLUBILITY IN WATER @ 68°F (20°C) Bunsen coefficient = 1.047	FREEZING POINT Triple point = -113°F (-80.55°C)
APPEARANCE AND ODOR Pure acetylene is a colorless gas with an ethereal odor. Commercial (carbide) acetylene has a distinctive garlic-like odor. Spec. Grav. (Air=1.0) = 0.91 @ 70°F.	

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED) Gas	AUTO IGNITION TEMPERATURE 565°F (296°C)	FLAMMABLE LIMITS % BY VOLUME LEL=2.2; UEL=80-85* *See note on last page.
EXTINGUISHING MEDIA Carbon dioxide; dry chemical		ELECTRICAL CLASSIFICATION Class 1, Group A
SPECIAL FIRE FIGHTING PROCEDURES If possible, stop flow of escaping gas. Use water spray to cool surrounding containers. Keep personnel away since heated or burning cylinders can rupture violently.		
UNUSUAL FIRE AND EXPLOSION HAZARDS GASEOUS ACETYLENE IS SPONTANEOUSLY COMBUSTIBLE IN AIR AT PRESSURES ABOVE 30 PSIA (207 kPa). <div style="text-align: right;">(Continued on last page.)</div>		

REACTIVITY DATA

STABILITY Unstable	X	CONDITIONS TO AVOID Do not allow the free gas (outside of cylinder) to exceed 30 psia. (Continued on last page.)
Stable		
INCOMPATIBILITY (Materials to avoid) Oxygen and other oxidizers including all of the halogens and halogen compounds. Forms explosive acetylide compounds with (Continued on last page.)		
HAZARDOUS DECOMPOSITION PRODUCTS Carbon and hydrogen		
HAZARDOUS POLYMERIZATION May Occur		CONDITIONS TO AVOID
Will Not Occur	X	

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is in container or container valve, contact the closest Liquid Air Corporation location.

WASTE DISPOSAL METHOD

Do not attempt to dispose of waste or unused quantities. Return in the shipping container properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place to Liquid Air Corporation for proper disposal. For emergency disposal, contact the closest Liquid Air Corporation location.

EMERGENCY RESPONSE INFORMATION

IN CASE OF EMERGENCY INVOLVING THIS MATERIAL, CALL DAY OR NIGHT (800) 231-1366
OR CALL CHEMTREC AT (800) 424-9300



ADDITIONAL DATA

LIQUID DENSITY AT BOILING POINT: (Continued)

Solid density @ sublimation point = 45.51 lb/ft³ (729 kg/m³)

FLAMMABLE LIMITS % BY VOLUME: (Continued)

Note: Pure acetylene can ignite by decomposition above 30 psia (207 kPa); therefore, the UEL is 100% if the ignition source is of sufficient intensity.

UNUSUAL FIRE AND EXPLOSION HAZARDS: (Continued)

It requires a very low ignition energy so that fires which have been extinguished without stopping the flow of gas can easily reignite with possible explosive force. Acetylene has a density very similar to that of air so when leaking it does not readily dissipate.

CONDITIONS TO AVOID: (Continued)

Cylinders should not be exposed to sudden shock or sources of heat.

INCOMPATIBILITY (MATERIALS TO AVOID): (Continued)

copper, mercury, silver, brasses containing more than 66% copper and brazing materials containing silver or copper.

OTHER RECOMMENDATIONS OR PRECAUTIONS (Continued)

Possible increasing fire intensity and explosion hazard if cylinders are so piled or stacked that burning gas escaping from a melted fuse plug (pressure relief device) plays on other cylinders.

SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type) Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.

VENTILATION Hood with forced ventilation	LOCAL EXHAUST To prevent accumulation above the LEL.	SPECIAL
	MECHANICAL (Gen.) In accordance with electrical codes	OTHER

PROTECTIVE GLOVES

PVC or rubber in laboratory; as required for cutting & welding.

EYE PROTECTION

Safety goggles or glasses

OTHER PROTECTIVE EQUIPMENT

Safety shoes, safety shower

SPECIAL PRECAUTIONS***SPECIAL LABELING INFORMATION**

DOT Shipping Name: Acetylene DOT Hazard Class: Flammable gas
DOT Shipping Label: Flammable gas ID No.: UN 1001

SPECIAL HANDLING RECOMMENDATIONS

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when removing gas from the cylinder. DO NOT ALLOW THE FREE GAS TO EXCEED 30 PSIA (207 kPa) @ 70°F (21.1°C). Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

For additional handling recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130°F (54°C). Cylinders must be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time. Post "No Smoking or Open Flames" signs in the storage or use area. There should be no sources of ignition in the storage or use area.

For additional storage recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL PACKAGING RECOMMENDATIONS

Since acetylene will explode or combust if its pressure exceeds 30 psia (207 kPa) it is shipped dissolved in acetone or dimethylformamide which is dispersed in a porous mass within the cylinder. Follow Liquid Air Corporation's instructions for the maximum withdrawal rate for each size cylinder so that solvent is not withdrawn with the acetylene.

Most metals, except silver, copper, mercury or brasses with more than 66% copper, are compatible (non corrosive) with acetylene.

OTHER RECOMMENDATIONS OR PRECAUTIONS

Earth-ground and bond all lines and equipment associated with the acetylene system. Electrical equipment should be non-sparking or explosion proof. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR).

Transport cylinders in well-ventilated vehicles, upright and suitably restrained to prevent movement. (Continued on last page).

*Various Government agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage or use of this product which may not be contained herein. The customer or user of this product should be familiar with these regulations.



Material Safety Data Sheet

LIQUID AIR CORPORATION INDUSTRIAL GASES DIVISION One California Plaza, Suite 350 2121 N. California Blvd. Walnut Creek, California 94596	PRODUCT NAME Carbon Dioxide, Solid		CAS NUMBER 124-38-9
	TELEPHONE (415) 977-6500 EMERGENCY RESPONSE INFORMATION ON PAGE 2		
	TRADE NAME AND SYNONYMS Dry Ice, Solid Carbon Dioxide, Carbonice		
ISSUE DATE OCTOBER 1, 1985 AND REVISIONS CORPORATE SAFETY DEPT.	CHEMICAL NAME AND SYNONYMS Carbon Dioxide, Solid		CHEMICAL FAMILY Carbonate
	FORMULA CO ₂	MOLECULAR WEIGHT 44.01	

HEALTH HAZARD DATA (SEE NOTE ON LAST PAGE)

TIME WEIGHTED AVERAGE EXPOSURE LIMIT

5,000 Molar PPM. Its STEL is proposed to be changed from 15,000 Molar PPM to 30,000 Molar PPM (ACGIH, 1984-85).

SYMPTOMS OF EXPOSURE

Nervous system control of respiration is dependent on the CO₂ level breathed in air. By reducing the oxygen level in air, CO₂ can cause suffocation. Symptoms of overexposure include headache, dizziness, shortness of breath, muscular weakness, drowsiness and ringing in the ears. High concentrations produce a faint acid taste and can cause paralysis of the breathing control centers of the nervous system: 2% by volume in the atmosphere will cause a 50% increase in breathing rate; 3%, a 100% rate increase; >4% produces labored breathing and is dangerous for even a few (continued on last page)

TOXICOLOGICAL PROPERTIES

Carbon dioxide is the most powerful cerebral vasodilator known. Inhaling large concentrations causes rapid circulatory insufficiency leading to coma and death. Chronic, harmful effects are not known from repeated inhalation of low (3-5 molar %) concentrations.

Rat, inhalation LCLo 657,190 ppm for 15 minutes.

Rat (10 days preg.), inhalation TCLo 60,000 ppm, 24 hours teratogenic effects.

Human, inhalation TCLo 2,000 ppm pulmonary effects.

Frostbite effects are a change in the color of the skin to gray or white possibly followed by blistering.

Listed as Carcinogen	National Toxicology	Yes <input type="checkbox"/>	I.A.R.C.	Yes <input type="checkbox"/>	OSHA	Yes <input type="checkbox"/>
or Potential Carcinogen	Program	No <input checked="" type="checkbox"/>	Monographs	No <input checked="" type="checkbox"/>		No <input checked="" type="checkbox"/>

RECOMMENDED FIRST AID TREATMENT

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVER-EXPOSURE TO CARBON DIOXIDE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS.

Inhalation: Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given mouth-to-mouth resuscitation and supplemental oxygen. Assure that vomited material does not obstruct the airway by use of positional drainage. Medical assistance should be sought immediately.

Frostbite: Flush affected areas with lukewarm water. DO NOT USE HOT WATER. A physician should see the patient promptly if the cryogenic "burn" has resulted in blistering of the dermal surface or deep tissue freezing.

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

forms carbonic acid in the presence of water. See REACTIVITY DATA Section.

PHYSICAL DATA

BOILING POINT Sublimation point = -109.3°F (-78.5°C)	Solid Density = 95.64 lb/ft ³ (1562 kg/m ³)
VAPOR PRESSURE @ 70°F (21.1°C) = 844.7 psia (5824 kPa)	GAS DENSITY AT 70°F, 1 atm @ 70°F (21.1°C) = .1144 lb/ft ³ (1.832 kg/m ³)
SOLUBILITY IN WATER @ 68°F (20°C) Bunsen Coefficient = .8704	FREEZING POINT -69.83°F (-56.57°C) @ 75.1 psia (518 kPa)
APPEARANCE AND ODOR White opaque solid; colorless, odorless gas.	

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED) N/A	AUTO IGNITION TEMPERATURE N/A	FLAMMABLE LIMITS % BY VOLUME N/A
EXTINGUISHING MEDIA Nonflammable, inert gas.		ELECTRICAL CLASSIFICATION Nonhazardous.
SPECIAL FIRE FIGHTING PROCEDURES Extinguishing media: Use water spray to cool fire-exposed containers to prevent rupture. This material is non-combustible. It can be used as a fire extinguishing agent primarily for its smothering effect (reduction of oxygen concentration to the point where the immediate atmosphere cannot support combustion).		
UNUSUAL FIRE AND EXPLOSION HAZARDS It is not effective for use on fires involving chemicals that have their own oxygen supply (i.e., cellulose nitrate); or on fires involving reactive metals (such as, potassium, sodium, magnesium, aluminum, titanium, and zirconium), or their hydrides as these materials can decompose carbon dioxide.		

REACTIVITY DATA

STABILITY Unstable		CONDITIONS TO AVOID
Stable	X	CO ₂ is stable under ordinary conditions of use and storage. It does not polymerize. It does cause (continued on last page)
INCOMPATIBILITY (Materials to avoid) An explosion can occur when CO ₂ contacts mixtures of sodium peroxide with aluminum or magnesium. Reactive metals (continued on last page)		
HAZARDOUS DECOMPOSITION PRODUCTS Carbon monoxide.		
HAZARDOUS POLYMERIZATION May Occur		CONDITIONS TO AVOID
Will Not Occur	X	

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED Evacuate area of major spill or release of CO ₂ . Notify safety personnel. Provide ventilation. Clean-up personnel need special training and protection against contact with very cold materials or excessive inhalation of gaseous CO ₂ . (See note on last page.)
WASTE DISPOSAL METHOD Allow gas to bleed off at a moderate rate or solid to sublime to a well ventilated area. (See note on last page.)

EMERGENCY RESPONSE INFORMATION

IN CASE OF EMERGENCY INVOLVING THIS MATERIAL, CALL DAY OR NIGHT (800) 231-1366
OR CALL CHEMTREC AT (800) 424-9300



ORIGINAL

ADDITIONAL DATA

HEALTH HAZARD DATA: (Continued)

Note: Except where specified, the health hazard data and most of the other data in this material safety data sheet are for gaseous carbon dioxide.

SYMPTOMS OF EXPOSURE: (Continued)

minutes of exposure; >12% causes rapid unconsciousness; a few hours exposure at 25% results in death.

SUMMARY: Inhalation: Low concentrations (3-5 molar %) cause increased respiration and headache. Eight to 15 molar % concentrations cause headache, nausea and vomiting which may lead to unconsciousness if not moved to open air or given oxygen. Higher concentrations cause rapid circulatory insufficiency leading to coma and death.

When refrigerated liquid carbon dioxide is vaporized through an orifice, it can form solid particles of carbon dioxide ("snow" or "dry ice" powder). Continuous dermal

contact with this cold snow could result in frostbite or cryogenic (freeze) "burns." Contact with the liquid or solid can produce frostbite and freeze burns.

REACTIVITY DATA: (Continued)

CONDITIONS TO AVOID (Continued)

violent polymerization of acrylaldehyde or ethyleneimine. It decomposes to CO and O₂ when heated above 1700°C. This weakly acidic material will react with alkaline materials to form carbonates and bicarbonates.

INCOMPATIBILITY (MATERIALS TO AVOID) (Continued)

(such as alkali metals, magnesium, aluminum, titanium, or zirconium), their hydrides, and materials like diethyl magnesium, moist cesium oxide, or lithium acetylide with ammonia can ignite in a CO₂ atmosphere. Dry ice can form shock sensitive mixtures with sodium, potassium, or sodium-potassium alloy.

NOTES ON SPILL OR LEAK PROCEDURES: (Continued)

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED (Continued)

Solid carbon dioxide is generally delivered to customers in kraft-paper-wrapped blocks which weigh approximately 50 pounds and are approximately one half a cubic foot in volume. The product should be stored in insulated containers which open from the top having loose-fitting lids so that the carbon dioxide vapor from sublimation of the solid may be allowed to escape into the atmosphere.

WASTE DISPOSAL METHOD (Continued)

The insulated storage container should be located in an area where there is adequate ventilation so as to prevent the accumulation of carbon dioxide vapors above the TWA. Carbon dioxide vapors are approximately one and one half times heavier than air. DO NOT PUT DRY ICE IN A CLOSED CONTAINER WHERE EVOLVED GAS CANNOT ESCAPE! Remove scrap solid ("snow" or "dry ice") to a hood with forced ventilation or to a remote outside area. Allow solid to sublime.

SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type) Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.

VENTILATION

LOCAL EXHAUST To prevent accumulation above the TWA.

SPECIAL

See local exhaust.

MECHANICAL (Gen.)

OTHER

PROTECTIVE GLOVES

Loose fitting, insulated.

EYE PROTECTION

Safety goggles or glasses.

OTHER PROTECTIVE EQUIPMENT

Safety shoes, solid CO₂ handling "tongs."

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION I.D. No.: UN 1845

DOT Shipping Label: None; See 49 CFR 173.615

DOT Shipping Name: Carbon Dioxide, Solid or Dry Ice or Carbonice

DOT Hazard Class: ORM-A

SPECIAL HANDLING RECOMMENDATIONS

See note on last page regarding Spill or Leak Procedures. Also see CGA Pamphlet G-6, Carbon Dioxide. Provide general and local exhaust ventilation to meet TLV requirements. Provide approved supplied-air or self-contained respirators for use in non-routine or emergency situations with exposure above the TLV. A full facepiece is required for concentrations >10%. Provide standby person(s) with rescue equipment where work is required at >15% CO₂ in air.

Workers should use gloves and may require additional protective clothing (apron, face shield, etc. which are resistant to low temperatures) to prevent freeze burns and frostbite if more than momentary contact with CO₂ at low temperature is possible.

For additional handling recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS

See note on last page regarding Spill or Leak Procedures. Also see CGA Pamphlet G-6, Carbon Dioxide.

For additional storage recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL PACKAGING RECOMMENDATIONS

(FOR GASEOUS CARBON DIOXIDE)

Dry carbon dioxide can be handled with most common structural materials. Moist carbon dioxide is corrosive by its formation of carbonic acid. For these applications, 316, 309 and 310 stainless steels may be used as well as Hastelloy A[®], B & C and Monel[®]. Ferrous nickel alloys are slightly corroded.

At normal temperatures, carbon dioxide is compatible with most plastics and elastomers. Also see CGA Pamphlet G-6.3 Carbon Dioxide Cylinder Filling and Handling Procedures for Beverage Plants.

OTHER RECOMMENDATIONS OR PRECAUTIONS

*Various Government agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage or use of this product which may not be contained herein. The customer or user of this product should be familiar with these regulations.



ORIGINAL

Material Safety Data Sheet

PRODUCT NAME Nitrogen		
TELEPHONE (415) 977-6500 EMERGENCY RESPONSE INFORMATION ON PAGE 2		
LIQUID AIR CORPORATION INDUSTRIAL GASES DIVISION One California Plaza, Suite 350 2121 N. California Blvd. Walnut Creek, California 94596	TRADE NAME AND SYNONYMS Nitrogen	CAS NUMBER 7727-37-9
	CHEMICAL NAME AND SYNONYMS Nitrogen	
ISSUE DATE OCTOBER 1, 1985 AND REVISIONS CORPORATE SAFETY DEPT.	FORMULA N ₂	MOLECULAR WEIGHT 28.013
		CHEMICAL FAMILY Inert gas

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT Nitrogen is defined as a simple asphyxiant. Oxygen levels should be maintained at greater than 18 molar percent at normal atmospheric (Continued on last page.)

SYMPTOMS OF EXPOSURE *

Effects of exposure to high concentrations so as to displace the oxygen in air necessary for life may include any, all or none of the following:

- o Loss of balance or dizziness;
- o Tightness in the frontal area of the forehead;

(Continued on last page.)

TOXICOLOGICAL PROPERTIES

Nitrogen is nontoxic but the liberation of a large amount in a confined area could displace the amount of oxygen in air necessary to support life.

Listed as Carcinogen
or Potential Carcinogen

National Toxicology
Program

Yes ☐
No ☒

I.A.R.C.
Monographs

Yes ☐
No ☒

OSHA Yes ☐
No ☒

RECOMMENDED FIRST AID TREATMENT

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO NITROGEN. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS.

Inhalation: Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given mouth-to-mouth resuscitation and supplemental oxygen. Medical assistance should be sought immediately.

PHYSICAL DATA

BOILING POINT -320.445°F (-195.803°C)	LIQUID DENSITY AT BOILING POINT 50.48 lb/ft ³ (808.607 kg/m ³)
VAPOR PRESSURE @ 70°F (21.1°C) above the critical temp. of -232.51°F (-146.95°C)	GAS DENSITY AT 70°F 1 atm .07245 lb/ft ³ (1.1605 kg/m ³)
SOLUBILITY IN WATER @ 68°F (20°C) Bunsen coefficient = .01557	FREEZING POINT -346.004°F (-210.002°C)
APPEARANCE AND ODOR Colorless, odorless gas. Specific gravity @70°F (Air = 1.0) is .97.	

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED) N/A	AUTO IGNITION TEMPERATURE N/A	FLAMMABLE LIMITS % BY VOLUME N/A
EXTINGUISHING MEDIA Nonflammable, inert gas		ELECTRICAL CLASSIFICATION Nonhazardous
SPECIAL FIRE FIGHTING PROCEDURES N/A		
UNUSUAL FIRE AND EXPLOSION HAZARDS N/A		

REACTIVITY DATA

STABILITY Unstable		CONDITIONS TO AVOID
Stable	X	
INCOMPATIBILITY (Materials to avoid) None		
HAZARDOUS DECOMPOSITION PRODUCTS None		
HAZARDOUS POLYMERIZATION May Occur		CONDITIONS TO AVOID
Will Not Occur	X	

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in container or container valve, contact the closest Liquid Air Corporation location.

WASTE DISPOSAL METHOD

Do not attempt to dispose of waste or unused quantities. Return in the shipping container properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place to Liquid Air Corporation for proper disposal. For emergency disposal, contact the closest Liquid Air Corporation location.

EMERGENCY RESPONSE INFORMATION

IN CASE OF EMERGENCY INVOLVING THIS MATERIAL, CALL DAY OR NIGHT (800) 231-1366
OR CALL CHEMTREC AT (800) 424-9300



ORIGINAL

ADDITIONAL DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT: (Continued)

pressure which is equivalent to a partial pressure of 135 mm Hg (ACGIH, 1984-85)

SYMPTOMS OF EXPOSURE: (Continued)

- o Tingling of the tongue, fingertips or toes;
- o Weakened speech leading to the inability to utter sounds;
- o Rapid reduction in the ability to perform movements;
- o Reduced consciousness of the surroundings.
- o Loss of tactile sensations.
- o Heightened mental activity.

It should be recognized that it is possible that none of the above symptoms may occur in nitrogen asphyxia so that there are no definite warning symptoms. Nitrogen can cause suffocation without warning.

* For additional information, refer to L'Air Liquide's Encyclopedia des Gaz.

LOCAL EXHAUST: (Continued)

To prevent accumulation of high concentrations so as to reduce the oxygen level in the air to less than 18 molar percent.

SPECIAL PROTECTION INFORMATION

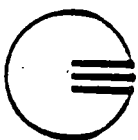
Page 3

RESPIRATORY PROTECTION (Specify type) Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.		
VENTILATION See Local Exhaust on last page.	LOCAL EXHAUST See last page.	SPECIAL
	MECHANICAL (Gen.)	OTHER
PROTECTIVE GLOVES Any material		
EYE PROTECTION Safety goggles or glasses		
OTHER PROTECTIVE EQUIPMENT Safety shoes		

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION DOT Shipping Name: Nitrogen or Nitrogen, Compressed I.D. No.: UN 1066 DOT Shipping Label: Nonflammable gas DOT Hazard Class: Nonflammable gas
SPECIAL HANDLING RECOMMENDATIONS Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3,000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder. For additional handling recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.
SPECIAL STORAGE RECOMMENDATIONS Protect cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130F (54C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time. For additional storage recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.
SPECIAL PACKAGING RECOMMENDATIONS Nitrogen is noncorrosive and may be used with any common structural material.
OTHER RECOMMENDATIONS OR PRECAUTIONS Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR).

*Various Government agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage or use of this product which may not be contained herein. The customer or user of this product should be familiar with these regulations.



Gillette Medical Evaluation Laboratories

401 Professional Drive
Gaithersburg, Maryland 20879
301-590-9781

ORIGINAL

MATERIAL SAFETY DATA SHEET

NAME: LIQUID PAPER CORRECTION FLUID (WHITE AND COLORS, LPCF-17)

CAS NO: NA

Effective Date: 11/12/92 Rev: 1

A. — IDENTIFICATION

Composition*	%	Formula:
Methylcyclohexane (108-87-2)		Mixture
Titanium Dioxide (13463-67-7)	-	Molecular Weight: NA
Mineral Spirits (64741-65-7)		Synonyms
Resin, Dispersant, Colorant(s)		Correction Fluid
Mustard Oil (57-06-7)		
Masking Fragrance		

B. — PHYSICAL DATA

Boiling Point ~212 °F ~100 °C	Melting Point NA °F NA °C	Freezing Point NA °F NA °C
Specific Gravity (H ₂ O=1) ~1.3	Vapor Density (air=1) 3.4	Vapor Pressure @ 100 °F 83 mmHg
Evaporation Butyl Acetate =1 >1	Saturation in Air (by volume @ °F) NA %	Autoignition Temperature °F °C NA
% Volatiles (by volume) ~40	Solubility in Water Negligible	pH NA

Appearance/Odor White or colored fluid with a pungent solvent odor.

Flash Point and Test Method(s) 25°F (Closed Cup) for product

Flammable Limits in Air

(% by volume) Lower 1.2 % Upper 6.7 %

C. — REACTIVITY

Stability	Conditions to Avoid	Polymerization	Conditions to Avoid
stable	X	Product is flammable. Avoid contact with open flame or other ignition sources.	may occur
unstable		will not occur	X
Incompatible Materials	Strong oxidizers	Hazardous Decomposition Products	Thermal degradation may produce oxides of carbon and nitrogen and various hydrocarbons.

IF MULTIPLE INGREDIENTS INCLUDE CAS NUMBERS FOR EACH

NA=NOT AVAILABLE

Footnotes:

Physical data, except Specific Gravity and % Volatiles, refers to Methylcyclohexane.

D — HEALTH HAZARD DATA

Occupational Exposure Limits (PEL'S, TLV'S, etc.)

8-hour TWA's: Methylcyclohexane - 400 ppm (OSHA/ACGIH)
Titanium Dioxide - 10 mg/cu m (OSHA/ACGIH)

These levels are not anticipated under foreseeable use conditions.

Warning Signals

NA

Routes/Effects of Exposure

1. Inhalation No adverse effects anticipated from normal use. If vapors are deliberately concentrated and inhaled (abuse), the following symptoms may occur: respiratory irritation, dizziness, drowsiness, headache, nausea, unconsciousness, convulsions, cardiac sensitization, coma and death. (Mustard oil is added to the product as an abuse deterrent.)

2. Ingestion No adverse effects anticipated from normal use. Depending on amount ingested, most of the symptoms described above may occur. Estimated LD₅₀ in rats is greater than 5 ml/kg or between 1 pint and 1 quart in humans (ref. Gosselin, Smith and Hodge, Clinical Toxicology of Commercial Products, 5th Ed., 1984). Aspiration may result in chemical pneumonitis.

3. Skin

a. Contact

No adverse effects anticipated from normal use. Irritation may occur if contact is prolonged/repeated.

b. Absorption

No adverse effects anticipated from normal use. Solvent can be absorbed through skin (prolonged contact), but not likely in acutely toxic amounts.

4. Eye Contact

If splashed into eye, irritation can occur.

5. Other

NA

E — ENVIRONMENTAL IMPACT

1. Applicable Regulations

NA

2. DOT Hazard Class —

3. DOT Shipping Name —

Environmental Effects

NA

H. — EMERGENCY PROCEDURES

Steps to be taken if material is released to the environment or spilled in the work area

Not applicable

Fire and Explosion Hazard

Product is flammable. May produce hazardous decomposition products.

Extinguishing Media

Dry chemical, foam, carbon dioxide.

Firefighting Procedures

In fires involving large quantities of product, use self-contained breathing apparatus. Cool fire-exposed containers with water fog/spray.

I. — FIRST AID AND MEDICAL EMERGENCY PROCEDURES

Eyes

Flush with plenty of water. If irritation persists, obtain medical attention.

Skin

Wash with soap and water.

Inhalation

No adverse effects anticipated from normal use. In an abuse situation, remove from source of exposure. Treat symptomatically. Oxygen may be administered. Seek medical attention immediately and refer to "Notes to Physician" below.

Ingestion

Consult physician.

Notes to Physician

Contains methylcyclohexane and mineral spirits which, if aspirated, may cause chemical pneumonitis. The inhalation of concentrated vapors may produce cardiac sensitization, contraindicating the use of sympathomimetic agents.

Replaces #799; title and appearance changes

The information contained in the Material Safety Data Sheet is based on data considered to be accurate, however, no warranty is expressed or implied regarding the accuracy of the data or the results to be obtained from the use thereof.

F. — EXPOSURE CONTROL METHODS

Engineering Controls

None under normal use conditions

Eye Protection

None under normal use conditions

Skin Protection

None under normal use conditions

Respiratory Protection

None under normal use conditions

Other

Product is non-hazardous when used as directed in an office/room with normal air circulation.

G. — WORK PRACTICES

Handling and Storage

Product is flammable. No unusual handling or storage when used as directed; when stored in large quantities (as in warehouse), it should be in a well-ventilated, cool area, away from ignition sources.

Normal Clean Up

Pick up spills with towels, tissues, etc.

Waste Disposal Methods

Dispose in accordance with applicable federal, state and local laws.

SANFORD CORPORATION
2740 WASHINGTON BLVD.
BELLWOOD, IL. 60104

Sanford Corporation has been advised by counsel that the OSHA Hazard Communication Standard does not apply to the Sanford product described in this MSDS. The reason for this exemption is contained in 29 CFR Part 1910.1200 (d) (5) (i) as amended August 31, 1997 per Federal Register Vol. 32, No. 41, p 31877-31878. The information contained in this MSDS is furnished to you for your information but is not meant to imply that the product is covered by the Hazard Communication Standard nor is the MSDS meant to comply with all requirements of the Hazard Communication Standard.

ORIGINAL

EMERGENCY TEL: 1-800-228-5635

DATE OF LAST REVISION:

June 20, 1991

DOCUMENT SEQUENCE NO.:

107-05

1. IDENTIFICATION:

NAME: Mean Streak[®] Waterproof Marking Stick

COLORS: Black, Red, Yellow, White

2. COMPOSITION:

Pigments

Gelling agents

Solvents: Ethylene glycol monobutyl ether . (111-76-2)

3. PHYSICAL DATA:

(for ethylene glycol monobutyl ether).

BOILING POINT:

340°F

SPECIFIC GRAVITY:

0.9 at 68/68°F (water = 1)

VAPOR PRESSURE:

0.6 mm Hg at 68°F

VAPOR DENSITY:

4.1 (air = 1)

EVAPORATION RATE:

0.07 (butyl acetate = 1)

SOLUBILITY IN WATER:

complete

APPEARANCE/ODOR:

water-white liquid; ether-like odor

FLASH POINT:

150°F (TCC)

LOWER FLAMMABILITY LIMIT:

1.1% at 200°F

UPPER FLAMMABILITY LIMIT:

12.7% at 275°F

ORIGINAL

REACTIVITY:

STABILITY: stable

POLYMERIZATION: will not occur

CONDITIONS TO AVOID: not available

INCOMPATIBLE MATERIALS: not available

HAZARDOUS DECOMPOSITION PRODUCTS: not available

5. HEALTH HAZARD DATA:

Avoid eye contact as irritation may result. Flush thoroughly and call physician if accidental eye contact occurs. May be harmful if swallowed. Keep out of reach of children.

Neither the product nor any of the ingredients has been found to be a carcinogen or potential carcinogen by NTP, IARC, or OSHA.

The product is considered safe when used under normal use conditions.

6. SAFE HANDLING AND USE PRECAUTIONS:

HANDLING AND STORAGE: Keep cap on marker when not in use.

CLEAN UP PROCEDURES: Discard as solid waste.

WASTE DISPOSAL MEANS: Discard as solid waste.

7. PERSONAL PROTECTION AND EXPOSURE CONTROL MEASURES:

EYE PROTECTION: None under normal use conditions.

SKIN PROTECTION: None under normal use conditions.

RESPIRATORY PROTECTION: None under normal use conditions.

VENTILATION: None under normal use conditions.



IF IT'S BORDEN-IT'S
GOT TO BE GOOD

MATERIAL SAFETY DATA SHEET

Emergency Telephone
(614) 431-6600

Borden, Inc.

Packaging and Industrial Products Division

180 EAST BROAD STREET, COLUMBUS, OHIO 43215

ORIGINAL

THE OSHA HAZARD COMMUNICATION STANDARD 29 CFR 1910.1200 REQUIRES THAT THE INFORMATION CONTAINED ON THESE SHEETS BE MADE AVAILABLE TO YOUR WORKER INSTRUCT YOUR WORKERS TO HANDLE THIS PRODUCT PROPERLY.

X
ATTN:
X
X,

NON-EMERGENCY TELEPHONE
800-848-9400 (MSDS, ORDER)
614-431-6680 (TECH. INFO)

DESCRIPTION: KRAZY GLUE REGULAR
PRODUCT TYPE: CYANOACRYLATE ADHESIVE
APPLICATION: KG583, KG585, KG824, KG847, KG852, KG872.

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SIGNAL WORD
CAUTION!

This material is a "health hazard" and/or a "physical hazard" as determined when reviewed according to the requirements of the Occupational Safety and Health Administration 29 CFR Part 1910.1200 "Hazard Communication" Standard.

CHEMICAL HAZARD RATING

HEALTH=2(moderate)
FIRE=2(moderate)
REACTIVITY=1(slight)

29CFR1910.1200 HAZARDOUS INGREDIENTS/REPORTED HEALTH EFFECTS

CAS/REGISTRY NO. MATERIAL DESCRIPTION

The ingredients listed below have been associated with one or more of the listed immediate and/or delayed(*) health hazards. Risk of damage and effects depends upon duration and level of exposure. BEFORE USING OR HANDLING, READ AND UNDERSTAND THE MSDS.

7085-85-0 ETHYL 2-CYANOACRYLATE
-- See Footnote C.
ACGIH TLV: NONE ESTABLISHED
OSHA PEL: NONE ESTABLISHED

Footnote C: As of the date of issuance of this document, this material has not been listed by NTP, IARC or OSHA as a carcinogen.

PHYSICAL DATA

PERCENT VOLATILES	NOT DETERMINED
PH @ 25 C	NOT AVAILABLE
SPECIFIC GRAVITY	1.05
APPEARANCE	COLORLESS LIQUID
AUTOIGNITION TEMPERATURE	NOT AVAILABLE
BOILING POINT	65 deg C

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APPLICATION: KG583, KG585, KG824, KG847, KG852, KG872.

PHYSICAL DATA

VAPOR DENSITY (AIR=1)	> 1
VAPOR PRESSURE, MM HG @ 20 C	0.17
EVAPORATION RATE (BUTYL ACETATE=1)	< 1
UP/LOW FLAMMABLE LIMITS	NOT AVAILABLE
UP/LOW EXPLOSIVE LIMITS, % BY VOL.	NOT AVAILABLE
FLASH POINT	83 deg C (CC)
FREEZING POINT	NOT AVAILABLE
ODOR	IRRITATING
ODOR THRESHOLD, PPM	NOT AVAILABLE
SOLUBILITY IN WATER	NEGLIGIBLE

IMMEDIATE HEALTH HAZARD DATA

SKIN ABSORPTION: Not toxic dermally when tested as described in 16 CFR Part 1500.3 (c) (1) and (2).

INGESTION: Not toxic orally when tested as described in 16 CFR Part 1500.3 (c) (1) and (2).

INHALATION: Not expected to be harmful under normal conditions of use. However, if allowed to become airborne, may cause irritation of nose, throat and lungs. Not toxic by inhalation when tested as described in 16 CFR Part 1500.3 (c) (1) and (2).

SKIN: May cause irritation on prolonged or repeated contact. Not a primary irritant (primary skin irritation index less than 5.0/8.0) when tested as described in 16 CFR Part 1500.41.

Bonds skin instantly.

EYES: Causes irritation. Irritating when tested as described in 16 CFR Part 1500.42. Bonds eyelids instantly.

HANDLING PRECAUTIONS

INHALATION: Avoid prolonged or repeated breathing of vapor.

SKIN: Avoid prolonged or repeated contact with skin.

EYES: Avoid contact with eyes.

Handle in accordance with good industrial hygiene and safety practices. These practices include avoiding unnecessary exposure and removal of the material from eyes, skin and clothing.

Wash thoroughly after handling.

EMERGENCY AND FIRST AID PROCEDURES

INGESTION: If accidentally swallowed, dilute by drinking large quantities of water. Immediately contact poison control center or hospital emergency room for any other additional treatment directions.

INHALATION: Remove to fresh air.

READ NEXT PAGE



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MATERIAL SAFETY DATA SHEET
Borden, Inc.
Packaging and Industrial Products Division
180 EAST BROAD STREET, COLUMBUS, OHIO 43215

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ORIGINAL

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=====

EMERGENCY AND FIRST AID PROCEDURES

SKIN CONTACT: If skin bonding occurs, soak in nail polish remover or acetone and carefully peel or roll skin apart (do not pull).
EYE CONTACT: If eye contact occurs, hold eyelid open and rinse thoroughly but gently with only water for 15 minutes and GET MEDICAL ATTENTION. Do not use any solvents to flush the eye and its surroundings. Liquid glue will sting eye temporarily. Solidified glue may irritate eye like a grain of sand and should be treated by an eye doctor.

=====

FIRE AND EXPLOSION HAZARD DATA

COMBUSTIBLE.

Keep away from heat and flame.
In case of fire, use water spray, dry chemical, foam or CO2. Use water to keep fire-exposed containers cool.

=====

REACTIVITY DATA

Normally stable, but may become unstable at high temperatures or may react with water.

Hazardous polymerization:

Will not occur.

Incompatibilities:

Water, alcohols, amines, bases and direct UV.

Other Hazards:

None known to Borden.

Decomposition products may include:

Oxides of carbon.

=====

CONTROL MEASURES

If airborne contaminants are generated when the material is heated or handled, sufficient ventilation in volume and air flow patterns should be provided to keep air contaminant concentration levels below acceptable criteria.

ENGINEERING CONTROLS: The following exposure control techniques may be used to effectively minimize employee exposure: local exhaust ventilation, enclosed system design, process isolation and remote control in combination with appropriate use of personal protective equipment and prudent work practices. These techniques may not necessarily address all issues pertaining to your operations. We, therefore, recommend that you consult with experts of your choice to determine whether or not your programs are adequate.

=====

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IF ITS BORDEN-ITS
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DESCRIPTION: KRAZY GLUE REGULAR
PRODUCT TYPE: CYANOACRYLATE ADHESIVE
APPLICATION: KG583, KG585, KG824, KG847, KG852, KG872.

PERSONAL PROTECTION INFORMATION

Use goggles if contact is likely.
Wear impervious gloves as required to prevent skin contact.

SPILL OR LEAK PROCEDURES

Eliminate all ignition sources.
Soak up with absorbent material and remove to a chemical disposal area.
Prevent entry into natural bodies of water.

WASTE DISPOSAL

Recover free liquid. Absorb residue and dispose of according to local, state/provincial, and federal requirements.
Empty container: May contain explosive vapors. DO NOT cut, puncture or weld on or nearby.

STORAGE PRECAUTIONS

Keep away from amines.
Store in cool, dry area away from sun and heat.
Keep containers tightly closed.
Exposure to small amounts of moisture, even moisture in air, causes polymerization and renders the product unusable.
Keep away from heat, sparks, flame and other ignition sources.

TRANSPORT INFORMATION

Not Regulated.

060 KG0583

PREVIOUS ISSUE: 22-JAN-93

CURRENT ISSUE: 03-MAY-94

PRINT DATE: 04-May-94 02:33 PM

THIS IS THE LAST PAGE



IF ITS BORDEN-ITS
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MATERIAL SAFETY DATA SHEET

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Borden, Inc.

Packaging and Industrial Products Division

180 EAST BROAD STREET, COLUMBUS, OHIO 43215

SARA TITLE III SECTION 313
AND 40 CFR Part 372
TOXIC CHEMICAL NOTIFICATION SHEET

ORIGINAL

KRAZY GLUE REGULAR

This product contains the following toxic chemical(s) subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986, and Subpart C-Supplier Notification Requirement of 40 CFR Part 372.

CAS Registry

Number

Chemical Name

Pct.

Weight

None required per SARA TITLE III SECTION 313

This Toxic Chemical Notification Sheet must not be detached from the Material Safety Data Sheet (MSDS). Any copying and redistribution of the MSDS shall include copying and redistribution of this notification sheet attached to copies of the MSDS subsequently redistributed.

060 KG0583

PRINT DATE: 04-May-94 02:34

ORIGINAL

DISCLAIMER

SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, CONCERNING THE PRODUCT OR THE MERCHANTABILITY OR FITNESS THEREOF FOR ANY PURPOSE OR CONCERNING THE ACCURACY OF ANY INFORMATION PROVIDED BY BORDEN, except that the product shall conform to contracted specifications, and that the product does not infringe any valid United States patent. The information provided herein was believed by Borden to be accurate at the time of preparation or prepared from sources believed to be reliable, but it is the responsibility of the user to investigate and understand other pertinent sources of information, to comply with all laws and procedures applicable to the safe handling and use of product and to determine the suitability of the product for its intended use. Buyer's exclusive remedy shall be for damages and no claim of any kind, whether as to product delivered or for non-delivery of product, and whether based on contract, breach of warranty, negligence or otherwise shall be greater in amount than the purchase price of the quantity of product in respect of which damages are claimed. In no event shall Seller be liable for incidental or consequential damages, whether Buyer's claim is based on contract, breach of warranty, negligence or otherwise.

ORIGINAL

3M GENERAL OFFICES -- 3M TYPE 164 TONER
MATERIAL SAFETY DATA SHEET
NSN: 685000N042102
Manufacturer's CAGE: 76381
Part No. Indicator: A
Part Number/Trade Name: 3M TYPE 164 TONER
=====

General Information
=====

Company's Name: 3M GENERAL OFFICES
Company's Street: 3M CENTER
Company's City: ST PAUL
Company's State: MN
Company's Country: US
Company's Zip Code: 55144-1000
Company's Emerg Ph #: 612-733-1110
Company's Info Ph #: 612-733-1110
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 01OCT92
Safety Data Review Date: 09AUG95
MSDS Serial Number: ESXNL
Hazard Characteristic Code: N1
=====

Ingredients/Identity Information
=====

Proprietary: NO
Ingredient: ACRYLIC ACID BUTYL ESTER POLYMER W/STYRENE; (STYRENE-BUTYL
ACRYLATE POLYMER (COMBINED W/ING 2))
Ingredient Sequence Number: 01
Percent: 60-95
NIOSH (RTECS) Number: 1005532AA
CAS Number: 25767-47-9
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: STYRENE ACRYLIC RESIN (COMBINED W/ING 1)
Ingredient Sequence Number: 02
Percent: 60-95
NIOSH (RTECS) Number: 1009836ST
CAS Number: 58353-09-6
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: SOLVENT BLACK 7; (C.I. SOLVENT BLACK 7)
Ingredient Sequence Number: 03
Percent: 3-7
NIOSH (RTECS) Number: 1003774SB
CAS Number: 8005-02-5
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: CARBON BLACK
Ingredient Sequence Number: 04
Percent: 1-5

NIOSH (RTECS) Number: FF5800000
CAS Number: 1333-86-4
OSHA PEL: 3.5 MG/M3
ACGIH TLV: 3.5 MG/M3

Proprietary: NO
Ingredient: PROPENE POLYMERS; (POLYPROPYLENE)
Ingredient Sequence Number: 05
Percent: 1-5

NIOSH (RTECS) Number: UD1842000
CAS Number: 9003-07-4
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: SILICA
Ingredient Sequence Number: 06
Percent: 0.1-1
NIOSH (RTECS) Number: 1002640SI
CAS Number: 7631-86-9
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

=====

Physical/Chemical Characteristics

=====

Appearance And Odor: FINE BLACK POWDER; ESSENTIALLY ODORLESS.
Boiling Point: N/A
Vapor Pressure (MM Hg/70 F): N/A
Vapor Density (Air=1): N/A
Specific Gravity: SUPP DATA
Evaporation Rate And Ref: NOT APPLICABLE
Solubility In Water: NIL
Percent Volatiles By Volume: N/A
pH: N/A

=====

Fire and Explosion Hazard Data

=====

Flash Point: NOT APPLICABLE
Lower Explosive Limit: N/A
Upper Explosive Limit: N/A
Extinguishing Media: WATER SPRAY, CARBON DIOXIDE OR DRY CHEMICAL.
Special Fire Fighting Proc: WEAR NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire And Expl Hazrds: DUST CLOUDS OF THIS MATERIAL IN COMBINATION W/AN IGNITION SOURCE MAY BE EXPLOSIVE.

=====

Reactivity Data

=====

Stability: YES
Cond To Avoid (Stability): ELEVATED STORAGE TEMPERATURES MAY CAUSE CLUMPING OF TONER POWDER.
Materials To Avoid: NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomp Products: COMBUSTION PRODUCTS MAY INCL CARBON DIOXIDE, CARBON MONOXIDE, HYDROCARBONS, STYRENE MONOMER & CARBON PARTICULATES.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT.

=====

Health Hazard Data

=====

LD50-LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.

ORIGINAL

Route Of Entry - Inhalation: YES

Route Of Entry - Skin: NO

Route Of Entry - Ingestion: YES

Health Haz Acute And Chronic: INHAL:IRRIT (UPPER RESP) WHICH CAN INCL SORENESS OF NOSE & THROAT, COUGHING & SNEEZING. HEART EFTS CAN INCL ARRHYTHMIA, HEART ATTACK & DEATH. SILICOSIS CAN INCL SHORTNESS OF BREATH & PERSISTENT COUGHING. PNEUMOCONIOSIS (GEN) CAN INCL PERSISTENT COUGHING & SHORTNESS OF BREATH. INGEST:IRRIT OF GI TISS (EFTS OF OVEREXP)

Carcinogenicity - NTP: NO

Carcinogenicity - IARC: NO

Carcinogenicity - OSHA: NO

Explanation Carcinogenicity: NOT RELEVANT.

Signs/Symptoms Of Overexp: HLTH HAZ:WHICH CAN INCLUDE PAIN, VOMITING, ABDOMINAL TENDERNESS, NAUSEA, BLOOD IN VOMITUS & BLOOD IN FECES.

MECH EYE IRRIT WHICH CAN INCL IRRIT, REDNESS, SCRATCHING OF CORNEA & TEARING. SKIN CONT:MECH SKIN IRRIT WHICH CAN INCL ITCHING & REDNESS.

Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.

Emergency/First Aid Proc: EYES:IMMEDIATELY FLUSH W/LARGE AMOUNTS OF WATER FOR AT LEAST 15 MINS. GET IMMEDIATE MEDICAL ATTENTION. SKIN:WASH AFFECTED AREA W/SOAP & WATER. INHAL:IF SIGNS & SYMPTOMS OCCUR, REMOVE PERSON TO FRESH AIR. IF SIGNS & SYMPTOMS CONTINUE, CALL MD. INGEST:DRINK TWO GLASSES OF WATER. CALL MD.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: OBSERVE PRECS FROM OTHER SECTIONS. VACUUM TO AVOID DUSTING. CAUTION! A VACUUM CLEANER COULD BE AN IGNIT SOURCE. CLEAN UP RESIDUE. PLACE IN CLSD CONTR. AVOID CREATING AIRBORNE DUST IN SPILL-CLEANUP OPERATIONS. CAUTION: PWDR SPILL ON FLOORS (SUPP DATA)

Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

Waste Disposal Method: INCINERATE IN AN INDUSTRIAL OR COMMERCIAL FACILITY. DISPOSE OF WASTE PRODUCT IN A SANITARY LANDFILL. SINCE REGULATIONS & LOCAL DISPOSAL OPTIONS VARY, CONSULT APPLICABLE FEDERAL, STATE & LOCAL REGULATIONS OR AUTHORITIES PRIOR TO DISPOSAL.

Precautions-Handling/Storing: STORE AT ROOM TEMPERATURE & AWAY FROM HEAT. KEEP AWAY FROM HEAT, SPARKS, OPEN FLAMES & OTHER SOURCES OF IGNITION. USE IN WELL-VENTILATED AREA.

Other Precautions: AVOID EYE & SKIN CONTACT. AVOID INHALATION OF DUST.

Control Measures

Respiratory Protection: NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN (FP N).

Ventilation: USE IN A WELL-VENTILATED AREA.

Protective Gloves: IMPERVIOUS GLOVES (FP N).

Eye Protection: ANSI APPROVED SAFETY GLASSES (FP N).

Other Protective Equipment: NONE SPECIFIED BY MANUFACTURER.

Work Hygienic Practices: WASH HANDS AFTER HANDLING & BEFORE EATING.

Suppl. Safety & Health Data: SPEC GRAV:0.3-0.5 (H*20=1) (BULK DENSITY).

SPILL PROC:MAY CREATE A SLIP HAZARD.

Transportation Data

Disposal Data

Label Data

Label Required: YES

ORIGINAL

Technical Review Date: 28JUL93

Label Status: G

Common Name: 3M TYPE 164 TONER

Chronic Hazard: NO

Signal Word: CAUTION!

Acute Health Hazard-Slight: X

Contact Hazard-Slight: X

Fire Hazard-None: X

Reactivity Hazard-None: X

Special Hazard Precautions: STORE AT ROOM TEMPERATURE AWAY FROM HEAT, SPARKS, OPEN FLAMES AND OTHER SOURCES OF IGNITION. ACUTE: INHAL:IRRITATION WHICH CAN INCLUDE SORENESS OF NOSE AND THROAT, COUGHING AND SNEEZING. HEART EFFECTS CAN INCLUDE ARRHYTHMIA, HEART ATTACK AND DEATH; SILICOSIS AND PNEUMOCONIOSIS. INGEST:IRRITATION OF GASTROINTESTINAL TISSUE WHICH CAN INCLUDE PAIN, VOMITING AND NAUSEA. EYES CONTACT:MECHANICAL IRRITATION WHICH MECHANICAL IRRITATION WHICH CAN INCLUDE ITCHING AND REDNESS. CHRONIC: NONE LISTED BY MANUFACTURER.

Protect Eye: Y

Protect Skin: Y

Protect Respiratory: Y

Label Name: 3M GENERAL OFFICES

Label Street: 3M CENTER

Label City: ST PAUL

Label State: MN

Label Zip Code: 55144-1000

Label Country: US

Label Emergency Number: 612-733-1110

MATERIAL SAFETY DATA SHEET
29 CFR 1910.1200 OSHA Hazard
Communication Rule Format

MINE SAFETY APPLIANCES COMPANY
P.O. Box 426
Pittsburgh, PA 15230
PHONE (412) 967-3000

ORIGINAL

PRODUCT IDENTITY

LABEL IDENTITY - P/N 34337 Cleaner-Sanitizer II

CHEMICAL NAME - See Applicable Chemical Contents

NOTE: Product is packaged in 2-ounce packets.

APPLICABLE CHEMICAL CONTENTS

		<u>%</u>	<u>TLV/TWA</u>
Alkyl (C14 - 50%, C12 - 40%, C16 - 10%) Dimethyl			
Benzyl Ammonium Chloride	CAS 68424-85-1	2.5	none established
Sodium Carbonate	CAS 497-19-8	25-50	none established
Sodium Bicarbonate	CAS 144-55-8	10-25	none established
Pentasodium Triphosphate	CAS 7758-29-4	10-25	none established
Water	CAS 7732-18-5	5-10	none established
Trisodium Phosphate	CAS 7601-54-9	1-10	none established
Nonoxynol - 10	CAS 127087-87-0	1-5	none established
Ethanol	CAS 64-17-5	0.1-1	1000 ppm

PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AND ODOR: White Powder, Unscented

BOILING POINT: N/A*

SPECIFIC GRAVITY (H₂O = 1): 0.8

VAPOR PRESSURE: N/A

PERCENT VOLATILE BY VOLUME: N/A

VAPOR DENSITY (AIR = 1): N/A

pH 1% Aqueous Solution: 9.5 - 10.5

SOLUBILITY IN WATER: 20%

* N/A - Not Applicable

PHYSICAL HAZARD INFORMATION

PHYSICAL HAZARD: Not a physical hazard as defined by OSHA's Hazard Communication Standard 29 CFR 1910.1200.

CONDITIONS OR MATERIALS TO AVOID: Avoid oxidizing agents. Soaps and anionic surfactants deactivate germicide.

FLASH POINT: No flash to 240°F LEL N/A UEL N/A

EXTINGUISHING MEDIA: Water spray (fog), foam, dry chemical, carbon dioxide.

SPECIAL FIRE FIGHTING PROCEDURES: Products of combustion are toxic. Wear impervious covering and pressure demand type self-contained breathing apparatus with full facepiece.

UNUSUAL FIRE AND EXPLOSION HAZARDS: See preceding item. Product is nonreactive and does not readily support combustion.

HEALTH HAZARDS

HEALTH HAZARDS: The powder product contains components which are toxic, corrosive and/or irritant. Ingestion of the product is harmful or fatal.

Toxicity Data

Alkyl (C14 - 50%; C12 - 40%; C16 - 10%) Dimethyl Benzyl

Ammonium Chloride	CAS 68424-85-1
Oral (RAT) LD50	0.43 ML/KG
Dermal LD50 (RABBIT)	3.56 ML/KG
Skin (RABBIT)	0.5 ML/24 Hr. Severe Irritant
Eye (RABBIT)	0.1 ML Severe Irritation

Sodium Carbonate	CAS 497-19-8
Oral (RAT) LD50	2.8 GM/KG
Oral (RAT) LD50	4090 MG/KG
Skin (RABBIT)	500 KG/24 Hr. Moderate
Eye (RABBIT)	100 MG-24 Hr. Moderate

Sodium Bicarbonate	CAS 144-55-8
Oral (INF.) TDLO	1260 MG/KG
Oral (RAT) LD50	4220 MG/KG
Skin (HMN)	30 MG/3D-I Mild
Eye (RABBIT)	100 MG/30 Sec. Rinse - Mild

Pentasodium Triphosphate	CAS 7758-29-4
Oral (RAT) LD50	4100 MG/KG
Oral (MOUSE) LD50	3210 MG/KG
Skin - No Data Found	
Eyes - No Data Found	

According to a vendor, this material is essentially non-irritating.

Trisodium Phosphate	CAS 7601-54-9
Oral (RAT) LD50	6500 MG/KG
Oral (RAT) LD50	7400 MG/KG
Skin (RABBIT) LD50 >	7940 MG/KG
Eyes - Irritating	

Nonoxynol - 10	CAS 127087-87-0
No oral or dermal toxicity data found.	
Eyes - severe irritant to eyes; possible corneal injury.	
Repeated contact may irritate the skin.	

Ethanol	CAS 64-17-5
Oral (HMN) LDLO	1400 MG/KG
Oral (RAT) LD50	7060 MG/KG
Oral (MOUSE) LD50	3450 MG/KG
Eye (RABBIT)	100 MG/24 Hr. Severe
Skin (RABBIT)	500 MG/24 Hr. Severe
Skin (RABBIT)	20 MG/24 Hr. Moderate

PRIMARY ROUTES OF ENTRY: Ingestion, skin contact, eye contact, inhalation.

ORIGINAL

SIGNS AND SYMPTOMS OF EXPOSURE: Ingestion of powder - Burning in mouth, throat, abdomen, severe swelling of larynx, muscle paralysis, convulsions.

Skin contact with powder - Irritation, may cause burns.

Eye contact with powder - Strong irritation, may cause corneal burns.

Inhalation - Irritation of mucous membranes.

NOTE: Inhalation of a quantity of powder sufficient to pose a significant health hazard is improbable under conditions of intended use.

TARGET ORGANS: Larynx, mucous membranes, digestive tract.

MEDICAL CONDITIONS GENERALLY RECOGNIZED AS BEING AGGRAVATED BY EXPOSURE:
No Information

EXPOSURE LIMITS: Refer to TLV/TWA on page 1 under "Applicable Chemical Contents".

CARCINOGENICITY DATA: Product components are not listed by OSHA, NTP, or IARC.

EMERGENCY AND FIRST AID PROCEDURES:

Ingestion: Drink milk, raw egg white, or gelatin solution, or large quantities of water. Avoid alcohol. See a physician immediately.

Note to Physician: Probable mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock, respiratory depression and convulsion may be needed.

Skin contact with powder: Flush affected area with clean water.

Eye contact with Powder: Avoid rubbing eyes as water insoluble particles may scratch cornea. Immediately flush eyes with clean water while holding eyelids apart. Continue flushing for at least 15 minutes or until irritation subsides. Consult a physician as soon as possible.

Inhalation of powder: Remove from exposure. See a physician if irritation persists.

SAFE HANDLING AND USE

HYGIENIC PRACTICES: Thoroughly rinse off any powder product contacted by skin surfaces.

PROTECTIVE MEASURES DURING REPAIR AND MAINTENANCE OR CONTAMINATED EQUIPMENT: N/A

PROCEDURES FOR SPILL OR LEAK CLEANUP: Sweep up packet contents. Avoid dusting conditions.

WASTE DISPOSAL: Dispose surplus product in accordance with local, state, and federal laws and regulations.

STORAGE: Store in a clean, dry place.

CONTROL MEASURES

PERSONAL PROTECTIVE EQUIPMENT: Wear rubber gloves to prevent skin contact with powder and to avoid frequent or extended skin contact with solution. Wear goggles to prevent eye contact with driven powder and to prevent eye splash with solution. A face shield can provide additional protection.

ENGINEERING CONTROLS: Not applicable.

WORK PRACTICES: Avoid dusting conditions. Remove and wash contaminated clothing. Do not mix this product with other cleaning products as soaps, anionic surfactants and oxidizing agents deactivate the germicide.

DATE OF PREPARATION: Rev. 3 February 1992

The information provided herein has been compiled from sources believed to be reliable. However, Mine Safety Appliances Company makes no warranty as to the accuracy, completeness, or sufficiency of the information and in no event will Mine Safety Appliances Company be responsible for loss or damage of any nature whatsoever resulting from use of the information.

ADVANTAGE BATTERY -- LEAD-ACID BATTERY - BATTERY, STORAGE
MATERIAL SAFETY DATA SHEET
NSN: 6140001951315
Manufacturer's CAGE: 0VW59
Part No. Indicator: A
Part Number/Trade Name: LEAD-ACID BATTERY
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General Information
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Item Name: BATTERY, STORAGE
Company's Name: ADVANTAGE BATTERY CORP
Company's Street: 3701 BEDFORD-EULESS RD SUITE 501
Company's City: HURST
Company's State: TX
Company's Country: US
Company's Zip Code: 76053
Company's Emerg Ph #: 817-589-1225, 800-424-9300 (CHEMTREC)
Company's Info Ph #: 817-589-1225
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 003
Status: SE
Date MSDS Prepared: 15MAR95
Safety Data Review Date: 21MAY96
Supply Item Manager: CX
MSDS Preparer's Name: UNKNOWN
MSDS Serial Number: BYBYD
Specification Number: NONE
Spec Type, Grade, Class: NONE
Hazard Characteristic Code: J6
Unit Of Issue: EA
Unit Of Issue Container Qty: 1 BATTERY
Type Of Container: POLYPROPYLENE
Net Unit Weight: UNKNOWN
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Ingredients/Identity Information
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Proprietary: NO
Ingredient: INORGANIC LEAD (SARA 313) (CERCLA)
Ingredient Sequence Number: 01
Percent: 68-80
NIOSH (RTECS) Number: OF7525000
CAS Number: 7439-92-1
OSHA PEL: SEE 1910.1025
ACGIH TLV: 0.15MG/M3 DUST; 9495
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: ANTIMONY (SARA 313) (CERCLA)
Ingredient Sequence Number: 02
Percent: 1.5
NIOSH (RTECS) Number: CC4025000
CAS Number: 7440-36-0
OSHA PEL: 0.5 MG/M3
ACGIH TLV: 0.5 MG (SB)/M3; 9495
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: ARSENIC (SARA 313) (CERCLA)
Ingredient Sequence Number: 03

ORIGINAL

Percent: 0.2
NIOSH (RTECS) Number: CG0525000
CAS Number: 7440-38-2
OSHA PEL: SEE 1910.1018
ACGIH TLV: 0.01 MG/M3, A1; 9495
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: CALCIUM, METAL
Ingredient Sequence Number: 04
Percent: 0.2
NIOSH (RTECS) Number: EV8040000
CAS Number: 7440-70-2
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: TIN
Ingredient Sequence Number: 05
Percent: 0.2
NIOSH (RTECS) Number: XP7320000
CAS Number: 7440-31-5
OSHA PEL: 2 MG/M3
ACGIH TLV: 2 MG/M3; 9495
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: SULFURIC ACID (ELECTROLYTE) (SARA 302/313) (CERCLA)
Ingredient Sequence Number: 06
Percent: 11-23
NIOSH (RTECS) Number: WS5600000
CAS Number: 7664-93-9
OSHA PEL: 1 MG/M3
ACGIH TLV: 1 MG/M3/3 STEL; 9495
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: POLYPROPYLENE (CASE MATERIAL)
Ingredient Sequence Number: 07
Percent: 5-6
NIOSH (RTECS) Number: TR5000000
CAS Number: 9003-07-0
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: POLYETHYLENE (SEPARATOR MATERIAL)
Ingredient Sequence Number: 08
Percent: 1-2
NIOSH (RTECS) Number: TQ3325000
CAS Number: 9002-88-4
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

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Physical/Chemical Characteristics

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Appearance And Odor: POLYPROPYLENE CASE STORAGE BATTERY. BATTERY PRODUCT

HAS NO APPARENT ODOR.

Boiling Point: 230F, 110C

Melting Point: UNKNOWN

Vapor Pressure (MM Hg/70 F): 10

Vapor Density (Air=1): >1

Specific Gravity: 1.240 TO 1.280

Decomposition Temperature: UNKNOWN

Evaporation Rate And Ref: <1

Solubility In Water: COMPLETE

Corrosion Rate (IPY): UNKNOWN

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Fire and Explosion Hazard Data

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Flash Point: NOT APPLICABLE

Lower Explosive Limit: UNKNOWN

Upper Explosive Limit: UNKNOWN

Extinguishing Media: CARBON DIOXIDE, DRY CHEMICALS, FOAM.

Special Fire Fighting Proc: WEAR ACID-RESISTANT CLOTHING. CONTACT OF WATER WITH SULFURIC ACID MAY GENERATE HEAT. USE POSITIVE-PRESSURE, SCBA. SHUT OFF POWER.

Unusual Fire And Expl Hazrds: KEEP SPARKS, FLAMES AND OTHER IGNITION SOURCES AWAY FROM BATTERIES. EXPLOSION MAY RESULT FROM IMPROPER CHARGING AND IGNITION OF FLAMMABLE HYDROGEN GAS.

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Reactivity Data

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Stability: YES

Cond To Avoid (Stability): OVERCHARGING, IGNITION SOURCES.

Materials To Avoid: CONTACT OF ELECTROLYTE WITH STRONG REDUCING AGENTS, METALS, STRONG OXIDIZERS, WATER, ORGANIC MATERIAL.

Hazardous Decomp Products: SULFURIC ACID MIST, SULFUR TRIOXIDE, SULFUR DIOXIDE, HYDROGEN, CARBON MONOXIDE.

Hazardous Poly Occur: NO

Conditions To Avoid (Poly): NONE

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Health Hazard Data

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LD50-LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.

Route Of Entry - Inhalation: YES

Route Of Entry - Skin: YES

Route Of Entry - Ingestion: YES

Health Haz Acute And Chronic: HANDLING AND MAINTENANCE OF BATTERY MAY RESULT IN EXPOSURE TO SULFURIC ACID. EXPOSURE TO LEAD COMPONENTS SHOULD NOT OCCUR UNDER NORMAL CONDITIONS OF USE. ELECTROLYTE HARMFUL BY ALL ROUTES OF ENTRY. EYES: BURNS, CORNEA DAMAGE, BLINDNESS. SKIN: BURNS, ULCERATION. INHALATION: SEVERE IRRITATION. INGESTION: SEVERE IRRITATION.

Carcinogenicity - NTP: NO

Carcinogenicity - IARC: YES

Carcinogenicity - OSHA: NO

Explanation Carcinogenicity: LEAD IS LISTED BY IARC 2B, POSSIBLY CARCINOGENIC TO HUMANS.

Signs/Symptoms Of Overexp: ELECTROLYTE: EYES: SEVERE IRRITATION, BURNS, CORNEA DAMAGE, BLINDNESS. SKIN: SEVERE IRRITATION, BURNS, ULCERATION. INHALATION: MISTS/VAPORS MAY CAUSE SEVERE RESPIRATORY IRRITATION.

INGESTION: IRRITATION OF MOUTH, THROAT, ESOPHAGUS. INORGANIC LEAD: HEADACHE, FATIGUE, ABDOMINAL PAIN, LOSS OF APPETITE, MUSCULAR ACHES/WEAKNESS.

Med Cond Aggravated By Exp: SULFURIC ACID MIST MAY AGGRAVATE PULMONARY CONDITIONS. CONTACT WITH SKIN MAY AGGRAVATE ECZEMA AND OTHER SKIN DISEASES. INORGANIC LEAD EXPOSURE MAY AGGRAVATE KIDNEY, LIVER, AND NEUROLOGIC DISEASES.

ORIGINAL

Emergency/First Aid Proc: EYES: FLUSH WITH LARGE AMOUNTS OF WATER. GET PROMPT MEDICAL ATTENTION. SKIN: REMOVE CONTAMINATED CLOTHING. WASH AREA WITH LARGE AMOUNTS OF WATER. GET MEDICAL ATTENTION. INHALATION: MOVE TO FRESH AIR. RESTORE BREATHING AS NECESSARY. GET MEDICAL ATTENTION. INGESTION: DO NOT INDUCE VOMITING. GET IMMEDIATE MEDICAL ATTENTION.

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Precautions for Safe Handling and Use

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Steps If Matl Released/Spill: IF BATTERY BREAKS OR LEAKS ISOLATE AREA. NEUTRALIZE SMALL SPILLS OR LEAKS WITH BAKING SODA, SODA ASH, LIME. FOR LARGE SPILLS, STOP FLOW AND ABSORB WITH DRY SAND, SOIL, OR NON-COMBUSTIBLE ABSORBENT. PREVENT ACID DISCHARGE INTO SANITARY OR STORM SEWERS. Neutralizing Agent: USE SODA ASH, BAKING SODA, OR LIME TO NEUTRALIZE THE ACID ELECTROLYTE. Waste Disposal Method: NEUTRALIZED SPILL MAY BE DISPOSED OF AS NON-HAZARDOUS WASTE IF CONFIRMED BY TESTING. UNNEUTRALIZED SPILLS MAY BE HAZARDOUS WASTE DUE TO CORROSIVITY. RECYCLE SPENT LEAD-ACID BATTERIES THROUGH SECONDARY LEAD SMELTER. FOLLOW LOCAL, STATE, FEDERAL REGULATIONS. Precautions-Handling/Storing: STORE BATTERIES ON IMPERVIOUS SURFACES IN COOL, DRY AREA WITH ADEQUATE VENTILATION AND CONTAINMENT IN EVENT OF SPILLS. PROTECT FROM WEATHER CONDITIONS. Other Precautions: KEEP AWAY FROM FIRE, SPARKS, HEAT. HANDLE BATTERIES TO AVOID CONTAINER DAMAGE OR TURNOVER.

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Control Measures

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Respiratory Protection: NONE REQUIRED UNDER NORMAL CONDITIONS OF USE. HOWEVER, IF SULFURIC ACID MIST CONCENTRATION EXCEEDS PEL, USE NIOSH OR MSHA-APPROVED RESPIRATORS. Ventilation: BATTERIES SHOULD BE STORED/HANDLED IN WELL-VENTILATED AREAS. MECHANICAL VENTILATION, WHEN USED, SHOULD BE ACID-RESISTANT. Protective Gloves: WEAR ACID-RESISTANT GLOVES. Eye Protection: USE CHEMICAL GOGGLES OR FACE SHIELD. Other Protective Equipment: PROVIDE EYE WASH STATION AND SAFETY SHOWER IN AREAS WHERE SULFURIC ACID IS HANDLED IN CONCENTRATIONS >1%. Work Hygienic Practices: WASH AFTER HANDLING AND BEFORE EATING, DRINKING, OR SMOKING. LAUNDER CONTAMINATED CLOTHING BEFORE REUSE. Suppl. Safety & Health Data: SULFURIC ACID REACTS VIOLENTLY WITH STRONG REDUCING AGENTS, METALS, STRONG OXIDIZERS, AND WATER. CONTACT WITH METALS MAY GENERATE SULFUR DIOXIDE FUMES AND HYDROGEN GAS. CONTACT WITH COMBUSTIBLE AND ORGANIC MATERIAL MAY CAUSE FIRE AND EXPLOSION.

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Transportation Data

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Trans Data Review Date: 96024
DOT PSN Code: BQN
DOT Proper Shipping Name: BATTERIES, WET, FILLED WITH ACID
DOT Class: 8
DOT ID Number: UN2794
DOT Pack Group: III
DOT Label: CORROSIVE
IMO PSN Code: BWD
IMO Proper Shipping Name: BATTERIES, WET, FILLED WITH ACID
IMO Regulations Page Number: 8120
IMO UN Number: 2794
IMO UN Class: 8
IMO Subsidiary Risk Label: -
IATA PSN Code: CZM
IATA UN ID Number: 2794
IATA Proper Shipping Name: BATTERIES, WET, FILLED WITH ACID

ORIGINAL

IATA UN Class: 8
IATA Label: CORROSIVE
AFI PSN Code: CZM
AFI Prop. Shipping Name: BATTERIES, WET, FILLED WITH ACID
AFI Class: 8
AFI ID Number: UN2794
AFI Pack Group: III
AFI Basic Pac Ref: A12.5

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Disposal Data

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Label Data

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Label Required: YES
Technical Review Date: 24JAN96
Label Status: F
Common Name: LEAD-ACID BATTERY
Chronic Hazard: YES
Signal Word: DANGER!
Acute Health Hazard-Severe: X
Contact Hazard-Severe: X
Fire Hazard-Slight: X
Reactivity Hazard-None: X
Special Hazard Precautions: HANDLING BATTERY MAY RESULT IN EXPOSURE TO
SULFURIC ACID. EXPOSURE TO LEAD COMPONENTS SHOULD NOT OCCUR UNDER NORMAL
CONDITIONS OF USE. ACID HARMFUL BY ALL ROUTES OF ENTRY. EYES: BURNS, BLINDNESS.
SKIN: BURNS. INHALATION/INGESTION: SEVERE IRRITATION. STORE BATTERIES IN COOL,
DRY AREA WITH ADEQUATE VENTILATION AND CONTAINMENT. FIRST AID: EYES: FLUSH
WITH WATER. GET MEDICAL ATTENTION. SKIN: REMOVE CONTAMINATED CLOTHING. WASH
AREA WITH WATER. GET MEDICAL ATTENTION. INHALATION: MOVE TO FRESH AIR. RESTORE
BREATHING AS NECESSARY. GET MEDICAL ATTENTION. INGESTION: DO NOT INDUCE
VOMITING. GET MEDICAL ATTENTION. TARGET ORGANS: EYES, SKIN, RESPIRATORY SYSTEM,
TEETH, KIDNEYS, BLOOD, CNS
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: ADVANTAGE BATTERY CORP
Label Street: 3701 BEDFORD-EULESS RD
Label City: HURST
Label State: TX
Label Zip Code: 76053
Label Country: US
Label Emergency Number: 817-589-1225, 800-424-9300 (CHEMTREC)

ORIGINAL

AVEX ELECTRONICS -- NICKEL-CADMIUM SEALED CELL BATTERY - BATTERY, STORAGE
 MATERIAL SAFETY DATA SHEET
 NSN: 6140004092250
 Manufacturer's CAGE: 58414
 Part No. Indicator: A
 Part Number/Trade Name: NICKEL-CADMIUM SEALED CELL BATTERY

General Information

Item Name: BATTERY, STORAGE
 Company's Name: AVEX ELECTRONICS CORP
 Company's Street: 1683 WINCHESTER ROAD
 Company's P. O. Box: 1026
 Company's City: BENSALEM
 Company's State: PA
 Company's Country: US
 Company's Zip Code: 19020-4510
 Company's Emerg Ph #: 215-638-3300
 Company's Info Ph #: 215-638-3300
 Record No. For Safety Entry: 001
 Tot Safety Entries This Stk#: 001
 Status: SE
 Date MSDS Prepared: 17AUG92
 Safety Data Review Date: 24OCT92
 Supply Item Manager: CX
 MSDS Serial Number: BPBYF
 Hazard Characteristic Code: N1
 Unit Of Issue: EA
 Unit Of Issue Container Qty: 1

Ingredients/Identity Information

Proprietary: NO
 Ingredient: CADMIUM AND CADMIUM COMPOUNDS
 Ingredient Sequence Number: 01
 Percent: 8-20
 NIOSH (RTECS) Number: 1008661CC
 OSHA PEL: NOT ESTABLISHED
 ACGIH TLV: NOT ESTABLISHED
 Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
 Ingredient: NICKEL AND NICKEL COMPOUNDS
 Ingredient Sequence Number: 02
 Percent: 15-35
 NIOSH (RTECS) Number: 1008662NC
 OSHA PEL: NOT ESTABLISHED
 ACGIH TLV: NOT ESTABLISHED
 Other Recommended Limit: NONE RECOMMENDED

Physical/Chemical Characteristics

Appearance And Odor: NOT SPECIFIED BY MANUFACTURER.
 Specific Gravity: 1.6

Fire and Explosion Hazard Data

Extinguishing Media: DRY CHEMICAL, CARBON DIOXIDE, OR WATER.
 Special Fire Fighting Proc: USE NIOSH/MSHA-APPROVED SELF-CONTAINED

ORIGINAL

BREATHING APPARATUS AND FULL-PROTECTIVE CLOTHING IF INVOLVED IN A FIRE.
Unusual Fire And Expl Hazrds: NONE

Reactivity Data

Stability: YES
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomp Products: METAL OXIDE FUMES MAY BE EVOLVED AT
TEMPERATURES ABOVE MELTING POINT.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT APPLICABLE

Health Hazard Data

LD50-LC50 Mixture: UNKNOWN
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: NO
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: INHALATION OF DUST OR FUME FROM CADMIUM AND
ITS COMPOUNDS MAY CAUSE IRRITATION OF THE NOSE AND THROAT. IF HIGH
CONCENTRATIONS ARE INHALED, A DELAYED REACTION MAY DEVELOP. NICKEL AND
CERTAIN NICKEL COMPOUNDS MAY CAUSE LOCAL DERMATITIS FROM SKIN CONTACT.
INHALATION AMY CAUSE UPPER RESPIRATORY IRRITATION.
Carcinogenicity - NTP: YES
Carcinogenicity - IARC: YES
Carcinogenicity - OSHA: YES
Explanation Carcinogenicity: THIS MATERIAL CONTAINS CADMIUM, NICKEL, AND
COMPOUNDS OF THESE TWO METALS.
Signs/Symptoms Of Overexp: IF HIGH CONCENTRATIONS ARE INHALED, A DELAYED
REACTION OF COUGHING, CHEST PAIN, SWEATING CHILLS, SHORTNESS OF BREATH AND
WEAKNESS MAY DEVELOP. LONG TERM EXPOSURE MAY CAUSE LUNG INJURY AND KIDNEY
DISFUNCTION. BONE LESIOUS CHARACTERIZED BY PAIN IN THE BACK AND EXTREMITIES
HAVE ALSO BEEN REPORTED.
Med Cond Aggravated By Exp: RESPIRATORY SYSTEM DISORDERS, PROSTATE
DISORDERS, LIVER AND KIDNEY DISORDERS.
Emergency/First Aid Proc: INHALATION- REMOVE FROM EXPOSURE, SEE PHYSICIAN.
INGESTION- INDUCE VOMITING IF CONSCIOUS, SEE A PHYSICIAN. SKIN OR EYES-
FLUSH WITH WATER FOR 15 MIN. SEE PHYSICIAN IF SYMPTOMS DEVELOP.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: CONTAIN THE SPILL. COLLECT THE SPILLED
MATERIAL AND PLACE IT IN A PLASTIC-LINED CONTAINER. HEPA VACUUMING IS
PREFERRED. FLUSH SPILL AREA WITH WATER/
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: DISPOSE IN ACCORDANCE WITH FEDERAL, STATE, AND
LOCAL LAWS. IF DISCARDED, TREAT AS HAZARDOUS.
Precautions-Handling/Storing: WEAR NIOSH/MSHA-APPROVED DUST MASKS OR
RESPIRATORS.
Other Precautions: KEEP CONTAINER CLOSED, AVOID CONTACT WITH CLOTHING,
AVOID GENERATING DUST.

Control Measures

Respiratory Protection: NIOSH/MSHA-APPROVED FOR DUSTS.
Ventilation: LOCAL EXHAUST AND MECHANICAL VENTILATION.
Protective Gloves: IMPERVIOUS.
Eye Protection: SAFETY GLASSES/GOGGLES.
Other Protective Equipment: NONE SPECIFIED BY MANUFACTURER.
Work Hygienic Practices: KEEP FOOD AND TOBACCO AWAY FROM WORK AREA.

CECOM SAFETY OFFICE -- LEAD-ACID (LA) BATTERY, VENTED, ETC11 - LEAD-ACID BATTERY, VENTED
MATERIAL SAFETY DATA SHEET
NSN: 6140009978805
Manufacturer's CAGE: 20058
Part No. Indicator: A
Part Number/Trade Name: LEAD-ACID (LA) BATTERY, VENTED, ETC11
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General Information
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Item Name: LEAD-ACID BATTERY, VENTED
Company's Name: CECOM SAFETY OFFICE
Company's Street: FORT MONMOUTH
Company's City: FORT MONMOUTH
Company's State: NJ
Company's Country: US
Company's Zip Code: 07703-5024
Company's Emerg Ph #: 908-544-3112
Company's Info Ph #: 908-544-3112
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SE
Date MSDS Prepared: 27AUG92
Safety Data Review Date: 31DEC92
MSDS Serial Number: BPZTB
Hazard Characteristic Code: NK
Unit Of Issue: EA
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Ingredients/Identity Information
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Proprietary: NO
Ingredient: LEAD (SARA III). ACGIH TLV FOR INORGANIC DUST AND FUME.
Ingredient Sequence Number: 01
Percent: 60-75
NIOSH (RTECS) Number: OF7525000
CAS Number: 7439-92-1
OSHA PEL: 0.05 MG/M3
ACGIH TLV: 0.15 MG/M3
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: LEAD DIOXIDE. OSHA PEL AND ACGIH TLV ARE FOR INORGANIC LEAD COMPOUNDS.
Ingredient Sequence Number: 02
Percent: 60-75
NIOSH (RTECS) Number: OG0700000
CAS Number: 1309-60-0
OSHA PEL: 0.05 MG(PB)/M3
ACGIH TLV: 0.15 MG(PB)/M3
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: LEAD SULFATE (SARA III). OSHA PEL AND ACGIH TLV ARE FOR INORGANIC LEAD COMPOUNDS.
Ingredient Sequence Number: 03
Percent: 60-75
NIOSH (RTECS) Number: OG4375000
CAS Number: 7446-14-2
OSHA PEL: 0.05 MG(PB)/M3
ACGIH TLV: 0.15 MG(PB)/M3

ORIGINAL

Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO

Ingredient: ANTIMONY (SARA III)

Ingredient Sequence Number: 04

Percent: <3

NIOSH (RTECS) Number: CC4025000

CAS Number: 7440-36-0

OSHA PEL: 0.5 MG/M3

ACGIH TLV: 0.5 MG/M3

Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO

Ingredient: ARSENIC (SARA III)

Ingredient Sequence Number: 05

Percent: <1

NIOSH (RTECS) Number: CG0525000

CAS Number: 7440-38-2

OSHA PEL: 0.5 MG/M3 (AS)

ACGIH TLV: 0.01, A1 MG/M3; 9394

Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO

Ingredient: SULFURIC ACID (SARA III)

Ingredient Sequence Number: 06

Percent: 10-30

NIOSH (RTECS) Number: WS5600000

CAS Number: 7664-93-9

OSHA PEL: 1 MG/M3

ACGIH TLV: 1 MG/M3

Other Recommended Limit: NONE RECOMMENDED

Physical/Chemical Characteristics

Appearance And Odor: NOT KNOWN

Boiling Point: NOT KNOWN

Melting Point: NOT KNOWN

Vapor Pressure (MM Hg/70 F): NOT KNOWN

Vapor Density (Air=1): NOT KNOWN

Specific Gravity: NOT KNOWN

Decomposition Temperature: NOT KNOWN

Evaporation Rate And Ref: NOT KNOWN

Solubility In Water: NOT KNOWN

Fire and Explosion Hazard Data

Flash Point: NOT KNOWN

Lower Explosive Limit: NOT KNOWN

Upper Explosive Limit: NOT KNOWN

Extinguishing Media: USE CARBON DIOXIDE OR DRY CHEMICAL FIRE EXTINGUISHER, 10-B:C.

Special Fire Fighting Proc: FIRE FIGHTERS SHOULD USE SELF-CONTAINED BREATHING APPARATUS (SCBA).

Unusual Fire And Expl Hazrds: BATTERY/CELLS MAY RELEASE TOXIC FUMES, IF SUBJECTED TO FIRE/EXTREME HEAT. STRONG BASES (E.G. POTASSIUM HYDROXIDE).

Reactivity Data

Stability: YES

Cond To Avoid (Stability): FIRE AND EXTREME HEAT. DO NOT SHORT CIRCUIT OR

ORIGINAL

OVERCHARGE.

Materials To Avoid: ALKALI MATERIALS

Hazardous Decomp Products: WHEN EXPOSED TO FIRE OR EXTREME HEAT, BATTERIES MAY EMIT ACID MIST AND/OR TOXIC FUMES.

Hazardous Poly Occur: NO

Conditions To Avoid (Poly): WILL NOT OCCUR.

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Health Hazard Data

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LD50-LC50 Mixture: NOT KNOWN

Route Of Entry - Inhalation: YES

Route Of Entry - Skin: NO

Route Of Entry - Ingestion: NO

Health Haz Acute And Chronic: INTACT BATTERIES PRESENT NO SPECIFIC HAZARDS. BURNING BATTERIES MAY EMIT TOXIC FUMES. LEAD IS KNOWN TO CAUSE REPROD DISORDERS (FEMALE, MALE AND/OR DEVEL) (CAL PROP 65, 1987).

Carcinogenicity - NTP: YES

Carcinogenicity - IARC: YES

Carcinogenicity - OSHA: YES

Explanation Carcinogenicity: LEAD & CMPD, INORG: INADEQ EVID FOR CARCIN IN HUMANS, SUFF IN ANIMALS (IARC 1987); SUSP HUMAN, KNOWN ANIMAL CARCIN (SUP DATA)

Signs/Symptoms Of Overexp: LEAKING BATTERIES LEAK CORROSIVE MATERIAL, IRRITATING TO EYES, SKIN, MUCOUS MEMBRANE. ELECTROLYTE EXPOSURE TO SKIN, EYES WILL CAUSE SEVERE IRRITATION, INHALATION OF FUMES MAY CAUSE SEVERE RESPIRATORY IRRITATION.

Med Cond Aggravated By Exp: BURNING AND SERVICING BATTERIES: RESPIRATORY AILMENTS. LEAKING BATTERIES: SKIN CONDITIONS.

Emergency/First Aid Proc: BATTERY CONTENTS IN CONTACT WITH EYES/SKIN: WASH AFFECTED AREA WITH CLEAN WATER FOR AT LEAST 15 MINUTES. DO NOT ATTEMPT TO NEUTRALIZE. SEEK MEDICAL ATTENTION PROMPTLY.

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Precautions for Safe Handling and Use

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Steps If Matl Released/Spill: AVOID SKIN OR EYE CONTACT. USE NONFLAMMABLE ABSORBENT FOR CLEANUP. COORDINATE WITH INSTALLATION SAFETY AND ENVIRONMENTAL OFFICES.

Neutralizing Agent: NOT KNOWN

Waste Disposal Method: DISPOSAL MUST BE IN ACCORDANCE WITH FEDERAL, STATE, AND LOCAL REGULATIONS. COORDINATE WITH SUPPORTING INSTALLATION AND/OR MACOM ENVIRONMENTAL OFFICE PRIOR TO DISPOSAL (FP A). LA BATTERIES CLASSIFIED AS HAZARDOUS WASTE UNDER RCRA. RECYCLING PREFERRED.

Precautions-Handling/Storing: DO NOT ABUSE OR SHORT CIRCUIT. WHEN STORING, STORE IN COOL, DRY AND WELL VENTILATED AREA, WHICH IS APPROVED BY LOCAL FIRE DEPARTMENT.

Other Precautions: DO NOT INVERT OR CAUSE TO SPILL. RECHARGE IAW METHODS SPECIFIED IN APPLICABLE TECHNICAL MANUAL.

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Control Measures

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Respiratory Protection: IF BATTERIES ARE BURNING USE SELF-CONTAINED BREATHING APPARATUS (SCBA).

Ventilation: WHEN SERVICING BATTERIES USE OSHA APPROVED FACILITY.

Protective Gloves: CHEMICALLY RESISTANT IF LEAKING.

Eye Protection: CHEMICAL SPLASH GOGGLES.

Other Protective Equipment: CHEMICALLY RESISTANT APRON.

Work Hygienic Practices: AVOID SKIN AND EYE CONTACT WITH ELECTROLYTE. DO NOT EAT OR SMOKE IN BATTERY SERVICE AREA.

SUFF EVID FOR CARCIN IN HUMANS, LTD IN ANIMALS (IARC 1987); KNOWN HUMAN CARCIN (NTP 1991); POTENTIAL CARCIN (OSHA); ACGIH: A1=HUMAN CARCIN (1992-93);

ORIGINAL

KNOWN TO CAUSE CANCER (CAL PROP 65, 1987).

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Transportation Data

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Trans Data Review Date: 92344
DOT PSN Code: BQN
DOT Proper Shipping Name: BATTERIES, WET, FILLED WITH ACID
DOT Class: 8
DOT ID Number: UN2794
DOT Pack Group: III
DOT Label: CORROSIVE
IMO PSN Code: BWD
IMO Proper Shipping Name: BATTERIES, WET, FILLED WITH ACID
IMO Regulations Page Number: 8120
IMO UN Number: 2794
IMO UN Class: 8
IMO Subsidiary Risk Label: -
IATA PSN Code: CZM
IATA UN ID Number: 2794
IATA Proper Shipping Name: BATTERIES, WET, FILLED WITH ACID
IATA UN Class: 8
IATA Label: CORROSIVE
AFI PSN Code: CZM
AFI Prop. Shipping Name: BATTERIES, WET, FILLED WITH ACID
AFI Class: 8
AFI ID Number: UN2794
AFI Pack Group: III
AFI Basic Pac Ref: 12-8
Additional Trans Data: PROTECT AGAINST SHORT CIRCUITING AND SPILLING.
SECURELY PACKAGE TO WITHSTAND CONDITIONS WHICH ARE NORMAL STORAGE AND
SHIPMENT. PACKAGE AND SHIP IAW DOT REGULATIONS.

=====

Disposal Data

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Label Data

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Label Required: YES
Technical Review Date: 31DEC92
Label Date: 29DEC92
Label Status: G
Common Name: LEAD-ACID (LA) BATTERY, VENTED, ETC11
Chronic Hazard: YES
Signal Word: CAUTION!
Acute Health Hazard-Slight: X
Contact Hazard-Slight: X
Fire Hazard-None: X
Reactivity Hazard-None: X
Special Hazard Precautions: INTACT BATTERIES PRESENT NO SPECIFIC HAZARDS.
BURNING BATTERIES MAY EMIT TOXIC FUMES. LEAKING BATTERIES LEAK CORROSIVE
MATERIAL IRRITATING TO SKIN, EYES AND MUCOUS MEMBRANES. LEAD IS KNOWN TO
CAUSE REPROD DISORDERS (FEMALE, MALE AND/OR DEVEL) (CAL PROP 65, 1987). FIRST
AID: BATTERY CONTENTS IN CONTACT WITH EYES/SKIN: WASH AFFECTED AREA WITH
CLEAN WATER FOR AT LEAST 15 MINUTES. DO NOT ATTEMPT TO NEUTRALIZE. SEEK
MEDICAL ATTENTION PROMPTLY.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: CECOM SAFETY OFFICE
Label Street: FORT MONMOUTH

ORIGINAL

Label City: FORT MONMOUTH

Label State: NJ

Label Zip Code: .07703-5024

Label Country: US

Label Emergency Number: 908-544-3112

ORIGINAL

Suppl. Safety & Health Data: NONE

Transportation Data

Trans Data Review Date: 92298
 DOT PSN Code: BQP
 DOT Proper Shipping Name: BATTERIES, WET, FILLED WITH ALKALI
 DOT Class: 8
 DOT ID Number: UN2795
 DOT Pack Group: III
 DOT Label: CORROSIVE
 IMO PSN Code: BWF
 IMO Proper Shipping Name: BATTERIES, WET, FILLED WITH ALKALI
 IMO Regulations Page Number: 8120
 IMO UN Number: 2795
 IMO UN Class: 8
 IMO Subsidiary Risk Label: -
 IATA PSN Code: CZR
 IATA UN ID Number: 2795
 IATA Proper Shipping Name: BATTERIES, WET, FILLED WITH ALKALI
 IATA UN Class: 8
 IATA Label: CORROSIVE
 AFI PSN Code: CZR
 AFI Prop. Shipping Name: BATTERIES, WET, FILLED WITH ALKALI
 AFI Class: 8
 AFI ID Number: UN2795
 AFI Pack Group: III
 AFI Basic Pac Ref: 12-8

Disposal Data

Label Data

Label Required: YES
 Technical Review Date: 24OCT92
 Label Status: F
 Common Name: NICKEL-CADMIUM SEALED CELL BATTERY
 Signal Word: WARNING!
 Acute Health Hazard-Moderate: X
 Contact Hazard-Moderate: X
 Fire Hazard-None: X
 Reactivity Hazard-None: X
 Special Hazard Precautions: INHALATION OF DUST OR FUME FROM CADMIUM AND ITS COMPOUNDS MAY CAUSE IRRITATION OF THE NOSE AND THROAT. IF HIGH CONCENTRATIONS ARE INHALED, A DELAYED REACTION MAY DEVELOP. NICKEL AND CERTAIN NICKEL COMPOUNDS MAY CAUSE LOCAL DERMATITIS FROM SKIN CONTACT. INHALATION MAY CAUSE UPPER RESPIRATORY IRRITATION. WEAR NIOSH/MSHA-APPROVED DUST MASKS OR RESPIRATORS. FIRST AID: INHALATION- REMOVE FROM EXPOSURE, SEE PHYSICIAN. INGESTION- INDUCE VOMITING IF CONSCIOUS, SEE A PHYSICIAN. SKIN OR EYES- FLUSH WITH WATER FOR 15 MIN. SEE PHYSICIAN IF SYMPTOMS DEVELOP.
 Protect Eye: Y
 Protect Skin: Y
 Protect Respiratory: Y
 Label Name: AVEX ELECTRONICS CORP
 Label Street: 1683 WINCHESTER ROAD
 Label P.O. Box: 1026
 Label City: BENSALEM
 Label State: PA
 Label Zip Code: 19020-4510

ORIGINAL

Label Country: US

Label Emergency Number: 215-638-3300

Material Safety Data Sheet

To comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200.

CLOR-N-OIL 50 PCB SCREENING KIT

Section I ---Manufacturer

Manufacturer's Name:

Exsil Corporation

Address:

One Hamden Park Drive

Hamden CT 06517

Emergency Telephone Number:

USA (800) 424-9300 INT'L (202) 483-7616

Telephone Number:

(203) 288-3509

Date Prepared: 11-16-93

Section II ---Identification of Hazardous Ingredient

The CLOR-N-OIL 50 PCB Screening Kit consists of one test tube containing two ampules, one test tube containing two ampules and an aqueous solution, and another separate ampule.

Component	Contents	TLV	CAS #	Hazard Class	UN Number
Ampule 1 (gray)	30 mg Sodium	NF	7440-23-5	4.3 Dangerous When Wet	1428
Ampule 2 (blue dot)	50 mg Naphthalene in Diglyme sol'n	50 mg/m ³ NF	91-20-3 111-96-6	4.1 Flam Solid 3 Flam Liquid	1334 1993
Ampule 3 (white dot)	0.5 mg Mercuric Nitrate in water	0.1 mg/m ³	10045-94-0	6.1 Poison	1625
Ampule 4 (red-green)	400 mg Ethanol	1900 mg/m ³	00064-17-5	3.2 Flam Liquid	1170
Ampule 5 (colorless)	0.50 ml Organo Sulfur Cmpd		Proprietary		
Aqueous sol'n	2% Sulfuric Acid (pH 1.4)	NF	7664-93-9	8 Corrosive	1830

Section III ---Physical Characteristics

Property	Ampule 1	Ampule 2	Ampule 3	Ampule 4	Ampule 5	Aqueous Sol'n
Boiling Pt °C	NA	168	100	78	100	>100
Vapor Pressure mm Hg @21°C	NA	1.7	18	44	18	16
Solubility in Water	reacts	75%	complete	miscible	miscible	complete
Specific Grav.	0.86	0.95	1.02	0.79	1.17	1.03
Percent volatile	none	100	none	99	none	none
Evaporation Rate, Butyl Acetate = 1	NA	0.36	NA	2.7	NA	NA
Appearance	gray	colorless	colorless	red-green	colorless	colorless
Odor	none	ether-like	none	pleasant	NA	none

Section IV ---Fire and Explosion Hazard

Flash Point	Ampule 1	>212 °F
	Ampule 2	135 °F
	Ampule 3	NA
	Ampule 4	55 °F
	Ampule 5	NA

Flammable Limit Unknown

Extinguishing Media DO NOT USE WATER ON A SODIUM FIRE. Dry chemical, foam, CO₂.

Special Fire Fighting Procedures

Do not use water. Wear SCBA. Avoid breathing sodium oxide fumes which will form on combustion.

Section V —Reactivity Data

Stability All components are stable.

Incompatible With

Do not expose broken sodium ampule to moisture. Keep from strong oxidizers.

Hazardous Decomposition Products

Sodium will form hydrogen and sodium oxide when moisture is present. Diglyme may form peroxides on exposure to air. Other solutions are stable.

Hazardous Polymerization Will not occur.

Conditions to Avoid Moisture with sodium ampule.

Section VI —Health Hazard Information

First Aid

In case of contact with reagents, rinse well with water. In case of inhalation, remove to fresh air.

Eye Contact

For all kit components, flush eyes with large amounts of water for 15 minutes. Seek medical attention.

Skin Contact

Flush with large amounts of water. Use soap and water to wash away organic components.

Inhalation

In case of inhalation, remove to fresh air.

Section VII —Spill, Leak, and Disposal Procedures

Spills and Leaks

Ampule 1 - Sodium ampule.

Cover with dry soda ash or salt. Store in a well ventilated area away from moisture.

Ampule 2 - Diglyme/Naphthalene ampule.

Absorb completely and dispose of as organic waste.

Ampule 3 - Mercuric Nitrate ampule.

Absorb completely and flush area with water.

Ampule 4 - Ethanol ampule.

Solvent absorbent recommended for spills. Flush area with water.

Aqueous Sol'n

Absorb completely and flush area with water.

Disposal

Pipette

May contain residual PCB's, dispose of in accordance with all applicable federal, state and local environmental regulations.

Test Tube 1

Contains reacted oil sample, organic liquid and possibly, residual PCBs. Dispose of as an organic waste in accordance with all applicable federal, state and local environmental regulations.

Test Tube 2

Upon completion of test including the addition of ampule 5, contents pass US EPA TCLP test. Dispose of in accordance with all applicable federal, state and local environmental regulations.

Section VIII —Special Protection Information

Respiratory protection

None required during normal use.

Ventilation

Perform test only in a well ventilated area.

Protective gloves

Always wear rubber gloves when performing the CLOR-N-OIL test. Viton gloves are recommended for use with PCBs.

Eye Protection

Wear safety glasses

Other Protective Equipment

Wear appropriate electrical safety equipment when performing test on site.

Section IX —Special Precautions and Comments

Storage and Handling Information

Store test kits in a cool, dry place.

DOT Class

Flammable Solid, Dangerous When Wet

Corrosive

NA = Not available or not applicable

NF = Not found

Liability is expressly disclaimed for any loss or injury arising out of the use of this information or the use of any materials designated; safe use of the materials is the responsibility of the user.

For additional information, contact Dexsil.

Material Safety Data Sheet

To comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200.

ORIGINAL

CLOR-N-SOIL 50 PCB SCREENING KIT

Section I — Manufacturer

Manufacturer's Name:

Oxsil Corporation

Address:

One Hamden Park Drive

Hamden CT 06517

Emergency Telephone Number:

USA (800) 424-9300 INT'L (202) 483-7616

Telephone Number:

(203) 288-3509

Date Prepared:

11-16-93

Section II — Identification of Hazardous Ingredient

The CLOR-N-SOIL 50 PCB Screening Kit consists of one test tube containing two ampules, one test tube containing two ampules and in aqueous solution, a separate ampule, a vial of extraction solvent, and a plastic drying column.

Component	Contents	TLV	CAS #	Hazard Class	UN Number
Ampule 1 gray-yellow dot)	60 mg Sodium	NF	7440-23-5	4.3 Dangerous When Wet	1428
Ampule 2 blue dot)	50 mg Naphthalene in Diglyme sol'n	50 mg/m ³ NF	91-20-3 111-96-6	4.1 Flam Solid 3 Flam Liquid	1334 1993
Ampule 3 brown dot)	0.5 mg Mercuric Nitrate in water	0.1 mg/m ³	10045-94-0	6.1 Poison	1625
Ampule 4 red-green)	400 mg Ethanol	1900 mg/m ³	00064-17-5	3.2 Flam Liquid	1170
Ampule 5 colorless)	0.50 ml Organo Sulfur Cmpd		Proprietary		
Aqueous sol'n	2% Sulfuric Acid (pH 1.4)	NF	7664-93-9	8 Corrosive	1830
Soil Extract	Butyl Diglyme	NF	112-73-23	3 Flam Liquid	1993
Drying Column	Florisil	NF	1343-90-4	None	None

Section III — Physical Characteristics

Property	Ampule 1	Ampule 2	Ampule 3	Ampule 4	Ampule 5	Aqueous Sol'n	Soil Extract	Drying Col
Boiling Pt °C	NA	168	100	78	100	>100	256	NA
Vapor Pressure mm Hg @21°C	NA	1.7	18	44	18	16	<0.01	NA
Solubility in Water	reacts	75%	complete	miscible	miscible	complete	0.3%	none
Specific Grav.	0.86	0.95	1.02	0.79	1.17	1.03	0.881	1.2
Percent Volatile	none	100	none	99	none	none	100	0
Evaporation Rate, Butyl Acetate = 1	NA	0.36	NA	2.7	NA	NA	<0.01	0
Appearance	gray	colorless	colorless	red-green	colorless	colorless	colorless	white crys.
Odor	none	ether-like	none	pleasant	NA	none	ether-like	none

Section IV — Fire and Explosion Hazard

Flash Point	Ampule 1	>212 ° F
	Ampule 2	135 ° F
	Ampule 3	NA
	Ampule 4	55 ° F
	Ampule 5	NA
	Extract Solvent	243 ° F
	Drying Column	None

Stable Limit Unknown

Extinguishing Media DO NOT USE WATER ON A SODIUM FIRE. Dry chemical, foam, CO₂.

Special Fire Fighting Procedures

Do not use water. Wear SCBA. Avoid breathing sodium oxide fumes which will form on combustion.

Section V --- Reactivity Data

Stability

All components are stable.

Incompatible With

Do not expose broken sodium ampule to moisture. Keep from strong oxidizers.

Hazardous Decomposition Products

Sodium will form hydrogen and sodium oxide when moisture is present. Diglyme may form peroxides on exposure to air. Other solutions are stable.

Hazardous Polymerization

Will not occur.

Conditions to Avoid

Moisture with sodium ampule.

Section VI --- Health Hazard Information

First Aid

In case of contact with reagents, rinse well with water. In case of inhalation, remove to fresh air.

Eye Contact

For all kit components, flush eyes with large amounts of water for 15 minutes. Seek medical attention.

Skin Contact

Flush with large amounts of water. Use soap and water to wash away organic components.

Inhalation

In case of inhalation, remove to fresh air.

Section VII --- Spill, Leak, and Disposal Procedures

Spills and Leaks

Ampule 1 - Sodium ampule.

Cover with dry soda ash or salt. Store in a well ventilated area away from moisture.

Ampule 2 - Diglyme/Naphthalene ampule.

Absorb completely and dispose of as organic waste.

Ampule 3 - Mercuric Nitrate ampule.

Absorb completely and flush area with water.

Ampule 4 - Ethanol ampule.

Solvent absorbent recommended for spills. Flush area with water.

Aqueous Sol'n

Rinse with water.

Soil Extraction Solvent

Absorb completely and dispose of as organic waste.

Disposal

Pipette

May contain residual PCB's, dispose of in accordance with all applicable federal, state and local environmental regulations.

Test Tube 1

Contains soil sample and extract. Dispose of as an organic waste in accordance with all applicable federal, state and local environmental regulations.

Test Tube 2

Contains reacted soil extract, organic liquid and possibly, residual PCBs. Dispose of as an organic waste in accordance with all applicable federal, state and local environmental regulations.

Test Tube 3

Upon completion of test including the addition of ampule 5, contents pass US EPA TCLP test. Dispose of in accordance with all applicable federal, state and local environmental regulations.

Section VIII --- Special Protection Information

Respiratory protection

None required during normal use.

Ventilation

Perform test only in a well ventilated area.

Protective gloves

Always wear rubber gloves when performing the CLOP-SOIL test. Viton gloves are recommended for use with PCBs.

Eye Protection

Wear safety glasses

Other Protective Equipment

Wear appropriate safety equipment when performing test on site.

Section IX --- Special Precautions and Comments

Storage and Handling Information

Store test kits in a cool, dry place.

DOT Class

Flammable Solid, Dangerous When Wet

Corrosive

NA = Not available or not applicable

NF = Not found

Liability is expressly disclaimed for any loss or injury arising out of the use of this information or the use of any materials designated; safe use of the materials is the responsibility of the user.

For additional information, contact Dexsil.

Appendix C

Heat and Cold Stress

ORIGINAL

atalogue, or a list of specialized customers, or a method of bookkeeping or other office management.

Secrecy. The subject matter of a trade secret must be secret. Matters of public knowledge or of general knowledge in an industry cannot be appropriated by one as his secret. Matters which are completely disclosed by the goods which one markets cannot be his secret. Substantially, a trade secret is known only in the particular business in which it is used. It is not requisite that only the proprietor of the business know it. He may, without losing his protection, communicate it to employees involved in its use. He may likewise communicate it to others pledged to secrecy. Others may also know of it independently, as, for example, when they have discovered the process or formula by independent invention and are keeping it secret. Nevertheless, a substantial element of secrecy must exist, so that, except by the use of improper means, there would be difficulty in acquiring the information. An exact definition of a trade secret is not possible. Some factors to be considered in determining whether given information is one's trade secret are: (1) The extent to which the information is known outside of his business; (2) the extent to which it is known by employees and others involved in his business; (3) the extent of measures taken by him to guard the secrecy of the information; (4) the value of the information to him and his competitors; (5) the amount of effort or money expended by him in developing the information; (6) the ease or difficulty with which the information could be properly acquired or duplicated by others.

Novelty and prior art. A trade secret may be a device or process which is patentable; but it need not be that. It may be a device or process which is clearly anticipated in the prior art or one which is merely a mechanical improvement that a good mechanic can make. Novelty and invention are not requisite for a trade secret as they are for patentability. These requirements are essential to patentability because a patent protects against unauthorized use of the patented device or process even by one who discovers it properly through independent research. The patent monopoly is a reward to the inventor. But such is not the case with a trade secret. Its protection is not based on a policy of rewarding or otherwise encouraging the development of secret processes or devices. The protection is merely against breach of faith and reprehensible means of learning another's secret. For this limited protection it is not appropriate to require also the kind of novelty and invention which is a requisite of patentability. The nature of the secret is, however, an important factor in determining the kind of relief that is appropriate against one who is subject to liability under the rule stated in this section. Thus, if the secret consists of a device or process which is a novel invention, one who acquires the secret wrongfully is ordinarily enjoined from further use of it and is required to account for the profits derived from his past use. If, on the other hand, the secret consists of mechanical improvements that a good mechanic can make without resort to the secret, the wrongdoer's liability may be limited to damages, and an injunction against future use of the improvements made with the aid of the secret may be inappropriate.

§1910.1450 Occupational exposure to hazardous chemicals in laboratories.

(a) **Scope and application** (1) This section shall apply to all employers engaged in the laboratory use of hazardous chemicals as defined below.

(2) Where this section applies, it shall supersede, for laboratories, the requirements of all other OSHA health standards in 29 CFR part 1910, subpart Z, except as follows:

(i) For any OSHA health standard, only the requirement to limit employee exposure to the specific permissible exposure limit shall apply for laboratories, unless that particular standard states otherwise or unless the conditions of paragraph (a)(2)(iii) of this section apply.

(ii) Prohibition of eye and skin contact where specified by any OSHA health standard shall be observed.

(iii) Where the action level (or in the absence of an action level, the permissible exposure limit) is routinely

exceeded for an OSHA regulated substance with exposure monitoring and medical surveillance requirements, paragraphs (d) and (g)(1)(ii) of this section shall apply.

(3) This section shall not apply to:

(i) Uses of hazardous chemicals which do not meet the definition of laboratory use, and in such cases, the employer shall comply with the relevant standard in 29 CFR part 1910, subpart Z, even if such use occurs in a laboratory.

(ii) Laboratory uses of hazardous chemicals which provide no potential for employee exposure. Examples of such conditions might include:

(A) Procedures using chemically-impregnated test media such as Dip-and-Read tests where a reagent strip is dipped into the specimen to be tested and the results are interpreted by comparing the color reaction to a color chart supplied by the manufacturer of the test strip; and

(B) Commercially prepared kits such as those used in performing pregnancy tests in which all of the reagents needed to conduct the test are contained in the kit.

(b) Definitions—

Action level means a concentration designated in 29 CFR part 1910 for a specific substance, calculated as an eight (8)-hour time-weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

Assistant Secretary means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

Carcinogen (see *select carcinogen*).

Chemical Hygiene Officer means an employee who is designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. This definition is not intended to place limitations on the position description or job classification that the designated individual shall hold within the employer's organizational structure.

Chemical Hygiene Plan means a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that (i) are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace and (ii) meets the requirements of paragraph (e) of this section.

Combustible liquid means any liquid having a flashpoint at or above 100°F (37.8°C), but below 200°F (93.3°C) except any mixture having components with flashpoints of 200 °F (93.3°C), or higher, the total vol-

Clinical Toxicology of Commercial Products Gleason, Gosselin, and Hooge.

Casarett and Doull's Toxicology; The Basic Science of Poisons Doull, Klaassen, and Amour, Macmillan Publishing Co., Inc., New York, NY.

Industrial Toxicology, by Alice Hamilton and Harriet L. Hardy Publishing Sciences Group, Inc., Acton, MA.

Toxicology of the Eye, by W. Morton Grant Charles C. Thomas, 301-327 East Lawrence Avenue, Springfield, IL.

Recognition of Health Hazards in Industry, William A. Burgess, John Wiley and Sons, 605 Third Avenue, New York, NY 10158.

Chemical Hazards of the Workplace, Nick H. Proctor and James P. Hughes, J.P. Lipincott Company, 6 Winchester Terrace, New York, NY 10022.

Handbook of Chemistry and Physics Chemical Rubber Company, 18901 Cranwood Parkway, Cleveland, OH 44128.

Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment and Biological Exposure Indices with Intended Changes, American Conference of Governmental Industrial Hygienists (ACGIH), 6500 Glenway Avenue, Bldg. D-5, Cincinnati, OH 45211. Information on the physical hazards of chemicals may be found in publications of the National Fire Protection Association, Boston, MA.

NOTE.—The following documents may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Occupational Health Guidelines NIOSH/OSHA (NIOSH Pub. No. 81-123).

NIOSH Pocket Guide to Chemical Hazards NIOSH Pub. No. 85-114.

Registry of Toxic Effects of Chemical Substances NIOSH Pub. No. 80-102.

Miscellaneous Documents published by the National Institute for Occupational Safety and Health:

Criteria documents.

Special Hazard Reviews.

Occupational Hazard Assessments.

Current Intelligence Bulletins.

OSHA's General Industry Standards (29 CFR Part 1910).

NTP Annual Report on Carcinogens and Summary of the Annual Report on Carcinogens, National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161; (703) 487-4850.

BIBLIOGRAPHIC DATA BASES

Service provider	File Name
Bibliographic Retrieval Services (BRS), 1200 Route 7, Latham, NY 12110	Biosis Previews CA Search Medlars NTIS Hazardline American Chemical Society Journal Excerpta Medica IRCS Medical Science Journal Pre-Med Int Pharmaceutical Abstracts Paper Chem

BIBLIOGRAPHIC DATA BASES, Continued

Service provider	File Name
Lockheed—DIALOG Information Service, Inc., 3480 Hillview Avenue, Palo Alto, CA 94304.	Biosis Prev. Files CA Search Files CAB Abstracts Chemical Exposure Chemname Chemsis Files Chemzero Embase Files Environmental Bibliographies Environline Federal Research in Progress IRL Life Science Collection NTIS Occupational Safety and Health (NIOSH) Paper Chem
SDC—Orbit, SDC Information Service, 2500 Colorado Avenue, Santa Monica, CA 90406	CAS Files Chemdex, 2, 3 NTIS
National Library of Medicine, Department of Health and Human Services, Public Health Service, National Institutes of Health, Bethesda, MD 20209.	Hazardous Substances Data Bank (NSDB) Medline files Toxline Files Cancerit RTECS Chemline
Pergamon International Information Corp., 1340 Old Chain Bridge Rd., McLean, VA 22101	Laboratory Hazard Bulletin
Questel, Inc., 1625 Eye Street, NW., Suite 818, Washington, DC 20006	CIS/LO Cancernet
Chemical Information System ICI (ICIS), Bureau of National Affairs, 1133 15th Street, NW., Suite 300, Washington, DC 20005	Structure and Nomenclature Search System (SANSS) Acute Toxicity (RTECS) Clinical Toxicology of Commercial Products Oil and Hazardous Materials Technical Assistance Data System CCRIS CESARS
Occupational Health Services, 400 Plaza Drive, Secaucus, NJ 07094	MSDS Hazardline

APPENDIX D TO §1910.1200—DEFINITION OF "TRADE SECRET" (MANDATORY)

The following is a reprint of the *Restatement of Torts* section 757, comment b (1939):

b. *Definition of trade secret.* A trade secret may consist of any formula, pattern, device or compilation of information which is used in one's business, and which gives him an opportunity to obtain an advantage over competitors who do not know or use it. It may be a formula for a chemical compound, a process of manufacturing, treating or preserving materials, a pattern for a machine or other device, or a list of customers. It differs from other secret information in a business (see §759 of the *Restatement of Torts* which is not included in this Appendix) in that it is not simply information as to single or ephemeral events in the conduct of the business, as, for example, the amount or other terms of a secret bid for a contract or the salary of certain employees, or the security investments made or contemplated, or the date fixed for the announcement of a new policy or for bringing out a new model or the like. A trade secret is a process or device for continuous use in the operations of the business. Generally it relates to the production of goods, as, for example, a machine or formula for the production of an article. It may, however, relate to the sale of goods or to other operations in the business, such as a code for determining discounts, rebates or other concessions in a price list or

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5. **Sensitizer:** A chemical that causes a substantial proportion of exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the chemical.

6. **Toxic:** A chemical falling within any of the following categories:

(a) A chemical that has a median lethal dose (LD₅₀) of more than 50 milligrams per kilogram but not more than 500 milligrams per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.

(b) A chemical that has a median lethal dose (LD₅₀) of more than 200 milligrams per kilogram but not more than 1,000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between two and three kilograms each.

(c) A chemical that has a median lethal concentration (LC₅₀) in air of more than 200 parts per million but not more than 2,000 parts per million by volume of gas or vapor, or more than two milligrams per liter but not more than 20 milligrams per liter of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

7. **Target organ effects.** The following is a target organ categorization of effects which may occur, including examples of signs and symptoms and chemicals which have been found to cause such effects. These examples are presented to illustrate the range and diversity of effects and hazards found in the workplace, and the broad scope employers must consider in this area, but are not intended to be all-inclusive.

a. Hepatotoxins	Chemicals which produce liver damage
Signs & Symptoms	Jaundice; liver enlargement
Chemicals	Carbon tetrachloride; nitrosamines
b. Nephrotoxins	Chemicals which produce kidney damage
Signs & Symptoms	Edema; proteinuria
Chemicals	Halogenated hydrocarbons; uranium
c. Neurotoxins	Chemicals which produce their primary toxic effects on the nervous system
Signs & Symptoms	Narcosis; behavioral changes; decrease in motor functions
Chemicals	Mercury; carbon disulfide
d. Agents which act on the blood or hematopoietic system	Decrease hemoglobin function; deprive the body tissues of oxygen
Signs & Symptoms	Cyanosis; loss of consciousness
Chemicals	Carbon monoxide; cyanides
e. Agents which damage the lung	Chemicals which irritate or damage the pulmonary tissue
Signs & Symptoms	Cough; tightness in chest; shortness of breath
Chemicals	Silica; asbestos
f. Reproductive toxins	Chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis)
Signs & Symptoms	Birth defects; sterility
Chemicals	Lead; DBCP
g. Cutaneous hazards	Chemicals which affect the dermal layer of the body
Signs & Symptoms	Defatting of the skin; rashes; irritation
Chemicals	Ketones; chlorinated compounds

h. Eye hazards Chemicals which affect the eye or visual capacity

Signs & Symptoms Conjunctivitis; corneal damage

Chemicals Organic solvents; acids

APPENDIX B TO §1910.1200—HAZARD DETERMINATION (MANDATORY)

The quality of a hazard communication program is largely dependent upon the adequacy and accuracy of the hazard determination. The hazard determination requirement of this standard is performance-oriented. Chemical manufacturers, importers, and employers evaluating chemicals are not required to follow any specific methods for determining hazards, but they must be able to demonstrate that they have adequately ascertained the hazards of the chemicals produced or imported in accordance with the criteria set forth in this Appendix.

Hazard evaluation is a process which relies heavily on the professional judgment of the evaluator, particularly in the area of chronic hazards. The performance-orientation of the hazard determination does not diminish the duty of the chemical manufacturer, importer or employer to conduct a thorough evaluation, examining all relevant data and producing a scientifically defensible evaluation. For purposes of this standard, the following criteria shall be used in making hazard determinations that meet the requirements of this standard.

1. **Carcinogenicity:** As described in paragraph (d)(4) and Appendix A of this section, a determination by the National Toxicology Program, the International Agency for Research on Cancer, or OSHA that a chemical is a carcinogen or potential carcinogen will be considered conclusive evidence for purposes of this section.

2. **Human data:** Where available, epidemiological studies and case reports of adverse health effects shall be considered in the evaluation.

3. **Animal data:** Human evidence of health effects in exposed populations is generally not available for the majority of chemicals produced or used in the workplace. Therefore, the available results of toxicological testing in animal populations shall be used to predict the health effects that may be experienced by exposed workers. In particular, the definitions of certain acute hazards refer to specific animal testing results (see Appendix A).

4. **Adequacy and reporting of data.** The results of any studies which are designed and conducted according to established scientific principles, and which report statistically significant conclusions regarding the health effects of a chemical, shall be a sufficient basis for a hazard determination and reported on any material safety data sheet. The chemical manufacturer, importer, or employer may also report the results of other scientifically valid studies which tend to refute the findings of hazard.

APPENDIX C TO §1910.1200—INFORMATION SOURCES (ADVISORY)

The following is a list of available data sources which the chemical manufacturer, importer, distributor, or employer may wish to consult to evaluate the hazards of chemicals they produce or import:

-Any information in their own company files, such as toxicity testing results or illness experience of company employees.

-Any information obtained from the supplier of the chemical, such as material safety data sheets or product safety bulletins.

-Any pertinent information obtained from the following source list (latest editions should be used):

Condensed Chemical Dictionary Van Nostrand Reinhold Co., 135 West 50th Street, New York, NY 10020.

The Merck Index: An Encyclopedia of Chemicals and Drugs Merck and Company, Inc., 128 E. Lincoln Ave., Rahway, NJ 07065.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man Geneva: World Health Organization, International Agency for Research on Cancer, 1972-Present. (Multivolume work). Summaries are available in supplement volumes. 49 Sheridan Street, Albany, NY 12210.

Industrial Hygiene and Toxicology, by F.A. Patty John Wiley & Sons, Inc., New York, NY (Multivolume work).

additional limitations or conditions upon the disclosure of the requested chemical information as may be appropriate to assure that the occupational health services are provided without an undue risk of harm to the chemical manufacturer, importer, or employer.

(11) If a citation for a failure to release specific chemical identity information is contested by the chemical manufacturer, importer, or employer, the matter will be adjudicated before the Occupational Safety and Health Review Commission in accordance with the Act's enforcement scheme and the applicable Commission rules of procedure. In accordance with the Commission rules, when a chemical manufacturer, importer, or employer continues to withhold the information during the contest, the Administrative Law Judge may review the citation and supporting documentation *in camera* or issue appropriate orders to protect the confidentiality of such matters.

(12) Notwithstanding the existence of a trade secret claim, a chemical manufacturer, importer, or employer shall, upon request, disclose to the Assistant Secretary any information which this section requires the chemical manufacturer, importer, or employer to make available. Where there is a trade secret claim, such claim shall be made no later than at the time the information is provided to the Assistant Secretary so that suitable determinations of trade secret status can be made and the necessary protections can be implemented.

(13) Nothing in this paragraph shall be construed as requiring the disclosure under any circumstances of process or percentage of mixture information which is a trade secret.

(i) **Effective dates.** (1) Chemical manufacturers, importers, and distributors shall ensure that material safety data sheets are provided with the next shipment of hazardous chemicals to employers after September 23, 1987.

(2) Employers in the non-manufacturing sector shall be in compliance with all provisions of this section by May 23, 1988. (Note: Employers in the manufacturing sector (SIC Codes 20 through 39) are already required to be in compliance with this section.)

APPENDIX A TO §1910.1200—HEALTH HAZARD DEFINITIONS (MANDATORY)

Although safety hazards related to the physical characteristics of a chemical can be objectively defined in terms of testing requirements (e.g. flammability), health hazard definitions are less precise and more subjective. Health hazards may cause measurable changes in the body—such as decreased pulmonary function. These changes are generally indicated by the occurrence of signs and symptoms in the exposed employees—such as shortness of breath, a non-measurable, subjective feeling. Employees exposed to such hazards must be apprised of both the change in body function and the signs and symptoms that may occur to signal that change.

The determination of occupational health hazards is complicated by the fact that many of the effects or signs and symptoms occur commonly in non-occupationally exposed populations, so that effects of exposure are difficult to separate from normally occurring illnesses. Occasionally, a substance causes an effect that is rarely seen in the population at large, such as angiosarcomas caused by vinyl chloride exposure, thus making

it easier to ascertain that the occupational exposure was the primary causative factor. More often, however, the effects are common, such as lung cancer. The situation is further complicated by the fact that most chemicals have not been adequately tested to determine their health hazard potential, and data do not exist to substantiate these effects.

There have been many attempts to categorize effects and to define them in various ways. Generally, the terms "acute" and "chronic" are used to delineate between effects on the basis of severity or duration. "Acute" effects usually occur rapidly as a result of short-term exposures, and are of short duration. "Chronic" effects generally occur as a result of long-term exposure, and are of long duration.

The acute effects referred to most frequently are those defined by the American National Standards Institute (ANSI) standard for Precautionary Labeling of Hazardous Industrial Chemicals (Z129.1-1982)—irritation, corrosivity, sensitization and lethal dose. Although these are important health effects, they do not adequately cover the considerable range of acute effects which may occur as a result of occupational exposure, such as, for example, narcosis.

Similarly, the term chronic effect is often used to cover only carcinogenicity, teratogenicity, and mutagenicity. These effects are obviously a concern in the workplace, but again, do not adequately cover the area of chronic effects, excluding, for example, blood dyscrasias (such as anemia), chronic bronchitis and liver atrophy.

The goal of defining precisely, in measurable terms, every possible health effect that may occur in the workplace as a result of chemical exposures cannot realistically be accomplished. This does not negate the need for employees to be informed of such effects and protected from them. Appendix B, which is also mandatory, outlines the principles and procedures of hazardous assessment.

For purposes of this section, any chemicals which meet any of the following definitions, as determined by the criteria set forth in Appendix B are health hazards:

1. **Carcinogen:** A chemical is considered to be a carcinogen if:

(a) It has been evaluated by the International Agency for Research on Cancer (IARC), and found to be a carcinogen or potential carcinogen; or

(b) It is listed as a carcinogen or potential carcinogen in the *Annual Report on Carcinogens* published by the National Toxicology Program (NTP) (latest edition); or

(c) It is regulated by OSHA as a carcinogen.

2. **Corrosive:** A chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact. For example, a chemical is considered to be corrosive if, when tested on the intact skin of albino rabbits by the method described by the U.S. Department of Transportation in Appendix A to 49 CFR Part 173, it destroys or changes irreversibly the structure of the tissue at the site of contact following an exposure period of four hours. This term shall not refer to action on inanimate surfaces.

3. **Highly toxic:** A chemical falling within any of the following categories:

(a) A chemical that has a median lethal dose (LD₅₀) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.

(b) A chemical that has a median lethal dose (LD₅₀) of 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between two and three kilograms each.

(c) A chemical that has a median lethal concentration (LC₅₀) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

4. **Irritant:** A chemical, which is not corrosive, but which causes a reversible inflammatory effect on living tissue by chemical action at the site of contact. A chemical is a skin irritant if, when tested on the intact skin of albino rabbits by the methods of 16 CFR 1500.41 for four hours exposure or by other appropriate techniques, it results in an empirical score of five or more. A chemical is an eye irritant if so determined under the procedure listed in 16 CFR 1500.42 or other appropriate techniques.

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(F) To design or assess engineering controls or other protective measures for exposed employees; and,

(G) To conduct studies to determine the health effects of exposure.

(iii) The request explains in detail why the disclosure of the specific chemical identity is essential and that, in lieu thereof, the disclosure of the following information to the health professional, employee, or designated representative, would not satisfy the purposes described in paragraph (i)(3)(ii) of this section:

(A) The properties and effects of the chemical;

(B) Measures for controlling workers exposure to the chemical;

(C) Methods of monitoring and analyzing worker exposure to the chemical; and,

(D) Methods of diagnosing and treating harmful exposures to the chemical;

(iv) The request includes a description of the procedures to be used to maintain the confidentiality of the disclosed information; and,

(v) The health professional, and the employer or contractor of the services of the health professional (i.e. downstream employer, labor organization, or individual employee), employee, or designated representative, agree in a written confidentiality agreement that the health professional, employee, or designated representative, will not use the trade secret information for any purpose other than the health need(s) asserted and agree not to release the information under any circumstances other than to OSHA, as provided in paragraph (i)(6) of this section, except as authorized by the terms of the agreement or by the chemical manufacturer, importer, or employer.

(4) The confidentiality agreement authorized by paragraph (i)(3)(iv) of this section:

(i) May restrict the use of the information to the health purposes indicated in the written statement of need;

(ii) May provide for appropriate legal remedies in the event of a breach of the agreement, including stipulation of a reasonable pre-estimate of likely damages; and,

(iii) May not include requirements for the posting of a penalty bond.

(5) Nothing in this standard is meant to preclude the parties from pursuing non-contractual remedies to the extent permitted by law.

(6) If the health professional, employee, or designated representative receiving the trade secret information decides that there is a need to disclose it to OSHA, the chemical manufacturer, importer, or employer who provided the information shall be informed by the health pro-

fessional, employee, or designated representative prior to, or at the same time as, such disclosure.

(7) If the chemical manufacturer, importer, or employer denies a written request for disclosure of a specific chemical identity, the denial must:

(i) Be provided to the health professional, employee, or designated representative, within thirty days of the request;

(ii) Be in writing;

(iii) Include evidence to support the claim that the specific chemical identity is a trade secret;

(iv) State the specific reasons why the request is being denied; and,

(v) Explain in detail how alternative information may satisfy the specific medical or occupational health need without revealing the specific chemical identity.

(8) The health professional, employee, or designated representative whose request for information is denied under paragraph (i)(3) of this section may refer the request and the written denial of the request to OSHA for consideration.

(9) When a health professional, employee, or designated representative refers the denial to OSHA under paragraph (i)(8) of this section, OSHA shall consider the evidence to determine if:

(i) The chemical manufacturer, importer, or employer has supported the claim that the specific chemical identity is a trade secret;

(ii) The health professional, employee, or designated representative has supported the claim that there is a medical or occupational health need for the information; and,

(iii) The health professional, employee, or designated representative has demonstrated adequate means to protect the confidentiality.

(10)(i) If OSHA determines that the specific chemical identity requested under paragraph (i)(3) of this section is not a *bona fide* trade secret, or that it is a trade secret, but the requesting health professional, employee, or designated representative has a legitimate medical or occupational health need for the information, has executed a written confidentiality agreement, and has shown adequate means to protect the confidentiality of the information, the chemical manufacturer, importer, or employer will be subject to citation by OSHA.

(ii) If a chemical manufacturer, importer, or employer demonstrates to OSHA that the execution of a confidentiality agreement would not provide sufficient protection against the potential harm from the unauthorized disclosure of a trade secret specific chemical identity, the Assistant Secretary may issue such orders or impose such

signed to cover groups of hazardous chemicals in a work area where it may be more appropriate to address the hazards of a process rather than individual hazardous chemicals. However, the employer shall ensure that in all cases the required information is provided for each hazardous chemical, and is readily accessible during each work shift to employees when they are in their work areas(s).

(11) Material safety data sheets shall also be made readily available, upon request, to designated representatives and to the Assistant Secretary, in accordance with the requirements of 29 CFR 1910.20 (e). The Director shall also be given access to material safety data sheets in the same manner.

(h) *Employee information and training.* Employers shall provide employees with information and training on hazardous chemicals in their work area at the time of their initial assignment, and whenever a new hazard is introduced into their work area.

(1) *Information.* Employees shall be informed of:

(i) The requirements of this section;

(ii) Any operations in their work area where hazardous chemicals are present; and,

(iii) The location and availability of the written hazard communication program, including the required list(s) of hazardous chemicals, and material safety data sheets required by this section.

(2) *Training.* Employee training shall include at least:

(i) Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);

(ii) The physical and health hazards of the chemicals in the work area;

(iii) The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used; and,

(iv) The details of the hazard communication program developed by the employer, including an explanation of the labeling system and the material safety data sheet, and how employees can obtain and use the appropriate hazard information.

(i) *Trade secrets.* (1) The chemical manufacturer, importer, or employer may withhold the specific chemical identity, including the chemical name and other specific

identification of a hazardous chemical, from the material safety data sheet, provided that:

(i) The claim that the information withheld is a trade secret can be supported;

(ii) Information contained in the material safety data sheet concerning the properties and effects of the hazardous chemical is disclosed;

(iii) The material safety data sheet indicates that the specific chemical identity is being withheld as a trade secret; and,

(iv) The specific chemical identity is made available to health professionals, employees, and designated representatives in accordance with the applicable provisions of this paragraph.

(2) Where a treating physician or nurse determines that a medical emergency exists and the specific chemical identity of a hazardous chemical is necessary for emergency or first-aid treatment, the chemical manufacturer, importer, or employer shall immediately disclose the specific chemical identity of a trade secret chemical to that treating physician or nurse, regardless of the existence of a written statement of need of a confidentiality agreement. The chemical manufacturer, importer, or employer may require a written statement of need and confidentiality agreement, in accordance with the provisions of paragraphs (i)(3) and (4) of this section, as soon as circumstances permit.

(3) In non-emergency situations, a chemical manufacturer, importer, or employer shall, upon request, disclose a specific chemical identity, otherwise permitted to be withheld under paragraph (i)(1) of this section, to a health professional (i.e. physician, industrial hygienist, toxicologist, epidemiologist, or occupational health nurse) providing medical or other occupational health services to exposed employee(s), and to employees or designated representatives, if:

(i) The request is in writing;

(ii) The request describes with reasonable detail one or more of the following occupational health needs for the information:

(A) To assess the hazards of the chemicals to which employees will be exposed;

(B) To conduct or assess sampling of the workplace atmosphere to determine employee exposure levels;

(C) To conduct pre-assignment or periodic medical surveillance of exposed employees;

(D) To provide medical treatment to exposed employees;

(E) To select or assess appropriate personal protective equipment for exposed employees;

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(3) The chemical and common name(s) of all ingredients which have been determined to present a physical hazard when present in the mixture;

(ii) Physical and chemical characteristics of the hazardous chemical (such as vapor pressure, flash point);

(iii) The physical hazards of the hazardous chemical, including the potential for fire, explosion, and reactivity;

(iv) The health hazards of the hazardous chemical, including signs and symptoms of exposure, and any medical conditions which are generally recognized as being aggravated by exposure to the chemical;

(v) The primary route(s) of entry;

(vi) The OSHA permissible exposure limit, ACGIH Threshold Limit Value, and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the material safety data sheet, where available;

(vii) Whether the hazardous chemical is listed in the National Toxicology Program (NTP) *Annual Report on Carcinogens* (latest edition) or has been found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) *Monographs* (latest editions), or by OSHA;

(viii) Any generally applicable precautions for safe handling and use which are known to the chemical manufacturer, importer or employer preparing the material safety data sheet, including appropriate hygienic practices, protective measures during repair and maintenance of contaminated equipment, and procedures for clean-up of spills and leaks;

(ix) Any generally applicable control measures which are known to the chemical manufacturer, importer or employer preparing the material safety data sheet, such as appropriate engineering controls, work practices, or personal protective equipment;

(x) Emergency and first aid procedures;

(xi) The date of preparation of the material safety data sheet or the last change to it; and,

(xii) The name, address and telephone number of the chemical manufacturer, importer, employer or other responsible party preparing or distributing the material safety data sheet, who can provide additional information on the hazardous chemical and appropriate emergency procedures, if necessary.

(3) If no relevant information is found for any given category on the material safety data sheet, the chemical manufacturer, importer or employer preparing the material safety data sheet shall mark it to indicate that no applicable information was found.

(4) Where complex mixtures have similar hazards and contents (i.e. the chemical ingredients are essentially the

same, but the specific composition varies from mixture to mixture), the chemical manufacturer, importer or employer may prepare one material safety data sheet to apply to all of these similar mixtures.

(5) The chemical manufacturer, importer or employer preparing the material safety data sheet shall ensure that the information recorded accurately reflects the scientific evidence used in making the hazard determination. If the chemical manufacturer, importer or employer preparing the material safety data sheet becomes newly aware of any significant information regarding the hazards of a chemical, or ways to protect against the hazards, this new information shall be added to the material safety data sheet within three months. If the chemical is not currently being produced or imported the chemical manufacturer or importer shall add the information to the material safety data sheet before the chemical is introduced into the workplace again.

(6) Chemical manufacturers or importers shall ensure that distributors and employers are provided an appropriate material safety data sheet with their initial shipment, and with the first shipment after a material safety data sheet is updated. The chemical manufacturer or importer shall either provide material safety data sheets with the shipped containers or send them to the employer prior to or at the time of the shipment. If the material safety data sheet is not provided with a shipment that has been labeled as a hazardous chemical, the employer shall obtain one from the chemical manufacturer, importer, or distributor as soon as possible.

(7) Distributors shall ensure that material safety data sheets, and updated information, are provided to other distributors and employers. Retail distributors which sell hazardous chemicals to commercial customers shall provide a material safety data sheet to such employers upon request, and shall post a sign or otherwise inform them that a material safety data sheet is available. Chemical manufacturers, importers, and distributors need not provide material safety data sheets to retail distributors which have informed them that the retail distributor does not sell the product to commercial customers or open the sealed container to use it in their own workplaces.

(8) The employer shall maintain copies of the required material safety data sheets for each hazardous chemical in the workplace, and shall ensure that they are readily accessible during each work shift to employees when they are in their work area(s).

(9) Where employees must travel between workplaces during a workshift, *i.e.*, their work is carried out at more than one geographical location, the material safety data sheets may be kept at a central location at the primary workplace facility. In this situation, the employer shall ensure that employees can immediately obtain the required information in an emergency.

(10) Material safety data sheets may be kept in any form, including operating procedures, and may be de-

(f) *Labels and other forms of warning.* (1) The chemical manufacturer, importer, or distributor shall ensure that each container of hazardous chemicals leaving the workplace is labeled, tagged or marked with the following information:

- (i) Identity of the hazardous chemical(s);
- (ii) Appropriate hazard warnings; and
- (iii) Name and address of the chemical manufacturer, importer, or other responsible party.

(2) For solid metal (such as a steel beam or a metal casting) that is not exempted as an article due to its downstream use, the required label may be transmitted to the customer at the time of the initial shipment, and need not be included with subsequent shipments to the same employer unless the information on the label changes. The label may be transmitted with the initial shipment itself, or with the material safety data sheet that is to be provided prior to or at the time of the first shipment. This exception to requiring labels on every container of hazardous chemicals is only for the solid metal itself and does not apply to hazardous chemicals used in conjunction with, or known to be present with, the metal and to which employees handling the metal may be exposed (for example, cutting fluids or lubricants).

(3) Chemical manufacturers, importers, or distributors shall ensure that each container of hazardous chemicals leaving the workplace is labeled, tagged, or marked in accordance with this section in a manner which does not conflict with the requirements of the Hazardous Materials Transportation Act (49 U.S.C. 1801 *et seq.*) and regulations issued under that Act by the Department of Transportation.

(4) If the hazardous chemical is regulated by OSHA in a substance-specific health standard, the chemical manufacturer, importer, distributor or employer shall ensure that the labels or other forms of warning used are in accordance with the requirements of that standard.

(5) Except as provided in paragraphs (f)(6) and (f)(7) the employer shall ensure that each container of hazardous chemicals in the workplace is labeled, tagged or marked with the following information:

- (i) Identity of the hazardous chemical(s) contained therein; and
- (ii) Appropriate hazard warnings.

(6) The employer may use signs, placards, process sheets, batch tickets, operating procedures, or other such written materials in lieu of affixing labels to individual stationary process containers, as long as the alternative method identifies the containers to which it is applicable and conveys the information required by paragraph (f)(5) of this section to be on a label. The written materials shall be readily accessible to the employees in their work area throughout each work shift.

(7) The employer is not required to label portable containers into which hazardous chemicals are transferred from labeled containers, and which are intended only for the immediate use of the employee who performs the transfer.

(8) The employer shall not remove or deface existing labels on incoming containers of hazardous chemicals, unless the container is immediately marked with the required information.

(9) The employer shall ensure that labels or other forms of warning are legible, in English, and prominently displayed on the container, or readily available in the work area throughout each work shift. Employers having employees who speak other languages may add the information in their language to the material presented, as long as the information is presented in English as well.

(10) The chemical manufacturer, importer, distributor or employer need not affix new labels to comply with this section if existing labels already convey the required information.

(g) *Material safety data sheets.* (1) Chemical manufacturers and importers shall obtain or develop a material safety data sheet for each hazardous chemical they produce or import. Employers shall have a material safety data sheet for each hazardous chemical which they use.

(2) Each material safety data sheet shall be in English and shall contain at least the following information:

(i) The identity used on the label, and, except as provided for in paragraph (i) of this section on trade secrets:

(A) If the hazardous chemical is a single substance, its chemical and common name(s);

(B) If the hazardous chemical is a mixture which has been tested as a whole to determine its hazards, the chemical and common name(s) of the ingredients which contribute to these known hazards, and the common name(s) of the mixture itself; or,

(C) If the hazardous chemical is a mixture which has not been tested as a whole:

(1) The chemical and common name(s) of all ingredients which have been determined to be health hazards, and which comprise 1% or greater of the composition, except that chemicals identified as carcinogens under paragraph (d)(4) of this section shall be listed if the concentrations are 0.1% or greater; and,

(2) The chemical and common name(s) of all ingredients which have been determined to be health hazards, and which comprise less than 1% (0.1% for carcinogens) of the mixture, if there is evidence that the ingredient(s) could be released from the mixture in concentrations which would exceed an established OSHA permissible exposure limit or ACGIH Threshold Limit Value, or could present a health hazard to employees; and,

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The chemical manufacturer, importer, or employer is still responsible for evaluating the hazards associated with the chemicals in these source lists in accordance with the requirements of this standard.

(4) Chemical manufacturers, importers and employers evaluating chemicals shall treat the following sources as establishing that a chemical is a carcinogen or potential carcinogen for hazard communication purposes:

(i) National Toxicology Program (NTP), *Annual Report on Carcinogens* (latest edition);

(ii) International Agency for Research on Cancer (IARC) *Monographs* (latest editions); or

(iii) 29 CFR Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration.

NOTE: The *Registry of Toxic Effects of Chemical Substances* published by the National Institute for Occupational Safety and Health indicates whether a chemical has been found by NTP or IARC to be a potential carcinogen.

(5) The chemical manufacturer, importer or employer shall determine the hazards of mixtures of chemicals as follows:

(i) If a mixture has been tested as a whole to determine its hazards, the results of such testing shall be used to determine whether the mixture is hazardous;

(ii) If a mixture has not been tested as a whole to determine whether the mixture is a health hazard, the mixture shall be assumed to present the same health hazards as do the components which comprise one percent (by weight or volume) or greater of the mixture, except that the mixture shall be assumed to present a carcinogenic hazard if it contains a component in concentrations of 0.1 percent or greater which is considered to be a carcinogen under paragraph (d)(4) of this section;

(iii) If a mixture has not been tested as a whole to determine whether the mixture is a physical hazard, the chemical manufacturer, importer, or employer may use whatever scientifically valid data is available to evaluate the physical hazard potential of the mixture; and,

(iv) If the chemical manufacturer, importer, or employer has evidence to indicate that a component present in the mixture in concentrations of less than one percent (or in the case of carcinogens, less than 0.1 percent) could be released in concentrations which would exceed an established OSHA permissible exposure limit or ACGIH Threshold Limit Value, or could present a health hazard to employees in those concentrations, the mixture shall be assumed to present the same hazard.

(6) Chemical manufacturers, importers, or employers evaluating chemicals shall describe in writing the procedures they use to determine the hazards of the chemical they evaluate. The written procedures are to be made available, upon request, to employees, their designated

representatives, the Assistant Secretary and the Director. The written description may be incorporated into the written hazard communication program required under paragraph (e) of this section.

(e) *Written hazard communication program.* (1) Employers shall develop, implement, and maintain at the workplace, a written hazard communication program for their workplaces which at least describes how the criteria specified in paragraphs (f), (g), and (h) of this section for labels and other forms of warning, material safety data sheets, and employee information and training will be met, and which also includes the following:

(i) A list of the hazardous chemicals known to be present using an identity that is referenced on the appropriate material safety data sheet (the list may be compiled for the workplace as a whole or for individual work areas); and,

(ii) The methods the employer will use to inform employees of the hazards of non-routine tasks (for example, the cleaning of reactor vessels), and the hazards associated with chemicals contained in unlabeled pipes in their work areas.

(2) *Multi-employer workplaces.* Employers who produce, use, or store hazardous chemicals at a workplace in such a way that the employees of other employer(s) may be exposed (for example, employees of a construction contractor working on-site) shall additionally ensure that the hazard communication programs developed and implemented under this paragraph (e) include the following:

(i) The methods the employer will use to provide the other employer(s) with a copy of the material safety data sheet, or to make it available at a central location in the workplace, for each hazardous chemical the other employer(s)' employees may be exposed to while working;

(ii) The methods the employer will use to inform the other employer(s) of any precautionary measures that need to be taken to protect employees during the workplaces normal operating conditions and in foreseeable emergencies; and,

(iii) The methods the employer will use to inform the other employer(s) of the labeling system used in the workplace.

(3) The employer may rely on an existing hazard communication program to comply with these requirements, provided that it meets the criteria established in this paragraph (e).

(4) The employer shall make the written hazard communication program available, upon request, to employees, their designated representatives, the Assistant Secretary and the Director, in accordance with the requirements of 29 CFR 1910.20(e).

the chemical. The identity used shall permit cross-references to be made among the required list of hazardous chemicals, the label and the MSDS.

Immediate use means that the hazardous chemical will be under the control of and used only by the person who transfers it from a labeled container and only within the work shift in which it is transferred.

Importer means the first business with employees within the Customs Territory of the United States which receives hazardous chemicals produced in other countries for the purpose of supplying them to distributors or employers within the United States.

Label means any written, printed, or graphic material, displayed on or affixed to containers of hazardous chemicals.

Material safety data sheet (MSDS) means written or printed material concerning a hazardous chemical which is prepared in accordance with paragraph (g) of this section.

Mixture means any combination of two or more chemicals if the combination is not, in whole or in part, the result of a chemical reaction.

Organic peroxide means an organic compound that contains the bivalent -O-O-structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical.

Oxidizer means a chemical other than a blasting agent or explosive as defined in §1910.109(a), that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

Physical hazard means a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.

Produce means to manufacture, process, formulate, or repackage.

Pyrophoric means a chemical that will ignite spontaneously in air at a temperature of 130°F (54.4°C) or below.

Responsible party means someone who can provide additional information on the hazardous chemical and appropriate emergency procedures, if necessary.

Specific chemical identity means the chemical name, Chemical Abstracts Service (CAS) Registry Number, or any other information that reveals the precise chemical designation of the substance.

Trade secret means any confidential formula, pattern, process, device, information or compilation of informa-

tion that is used in an employers business, and that gives the employer an opportunity to obtain an advantage over competitors who do not know or use it. Appendix D sets out the criteria to be used in evaluating trade secrets.

Unstable (reactive) means a chemical which in the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature.

Use means to package, handle, react, or transfer.

Water-reactive means a chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

Work area means a room or defined space in a workplace where hazardous chemicals are produced or used, and where employees are present.

Workplace means an establishment, job site, or project, at one geographical location containing one or more work areas.

(d) **Hazard determination.** (1) Chemical manufacturers and importers shall evaluate chemicals produced in their workplaces or imported by them to determine if they are hazardous. Employers are not required to evaluate chemicals unless they choose not to rely on the evaluation performed by the chemical manufacturer or importer for the chemical to satisfy this requirement.

(2) Chemical manufacturers, importers or employers evaluating chemicals shall identify and consider the available scientific evidence concerning such hazards. For health hazards, evidence which is statistically significant and which is based on at least one positive study conducted in accordance with established scientific principles is considered to be sufficient to establish a hazardous effect if the results of the study meet the definitions of health hazards in this section. Appendix A shall be consulted for the scope of health hazards covered, and Appendix B shall be consulted for the criteria to be followed with respect to the completeness of the evaluation, and the data to be reported.

(3) The chemical manufacturer, importer or employer evaluating chemicals shall treat the following sources as establishing that the chemicals listed in them are hazardous:

(i) 29 CFR Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA); or,

(ii) *Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment*, American Conference of Governmental Industrial Hygienists (ACGIH) (latest edition).

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Distributor means a business, other than a chemical manufacturer or importer, which supplies hazardous chemicals to other distributors or to employers.

Employee means a worker who may be exposed to hazardous chemicals under normal operating conditions or in foreseeable emergencies. Workers such as office workers or bank tellers who encounter hazardous chemicals only in non-routine, isolated instances are not covered.

Employer means a person engaged in a business where chemicals are either used, distributed, or are produced for use or distribution, including a contractor or subcontractor.

Explosive means a chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

Exposure or exposed means that an employee is subjected to a hazardous chemical in the course of employment through any route of entry (inhalation, ingestion, skin contact or absorption, etc.), and includes potential (e.g. accidental or possible) exposure.

Flammable means a chemical that falls into one of the following categories:

(i) **Aerosol, flammable** means an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame projection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening;

(ii) **Gas, flammable** means:

(A) A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of thirteen (13) percent by volume or less; or

(B) A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than twelve (12) percent by volume, regardless of the lower limit;

(iii) **Liquid, flammable** means any liquid having a flashpoint below 100°F (37.8°C), except any mixture having components with flashpoints of 100°F (37.8°C) or higher, the total of which make up 99 percent or more of the total volume of the mixture;

(iv) **Solid, flammable** means a solid, other than a blasting agent or explosive as defined in §1910.109 (a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate

greater than one-tenth of an inch per second along its major axis.

Flashpoint means the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested as follows:

(i) Tagliabue Closed Tester (See American National Standard Method of Test for Flash Point by Tag Closed Tester, Z11.24-1979 (ASTM D 56-79)) for liquids with a viscosity of less than 45 Saybolt Universal Seconds (SUS) at 100°F (37.8°C), that do not contain suspended solids and do not have a tendency to form a surface film under test; or

(ii) Pensky-Martens Closed Tester (See American National Standard Method of Test for Flash Point by Pensky-Martens Closed Tester, Z11.7-1979 (ASTM D 93-79)) for liquids with a viscosity equal to or greater than 45 SUS at 100°F (37.8°C), or that contain suspended solids, or that have a tendency to form a surface film under test; or

(iii) Setaflash Closed Tester (see American National Standard Method of Test for Flash Point by Setaflash Closed Tester (ASTMD 3278-78))

Organic peroxides, which undergo autoaccelerating thermal decomposition, are excluded from any of the flashpoint determination methods specified above.

Foreseeable emergency means any potential occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment which could result in an uncontrolled release of a hazardous chemical into the workplace.

Hazardous chemical means any chemical which is a physical hazard or a health hazard.

Hazard warning means any words, pictures, symbols, or combination thereof appearing on a label or other appropriate form of warning which convey the hazard(s) of the chemical(s) in the container(s).

Health hazard means a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes. Appendix A provides further definitions and explanations of the scope of health hazards covered by this section, and Appendix B describes the criteria to be used to determine whether or not a chemical is to be considered hazardous for purposes of this standard.

Identity means any chemical or common name which is indicated on the material safety data sheet (MSDS) for

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seq.) and regulations issued under that Act, when they are subject to the labeling requirements under that Act by the Food and Drug Administration;

(iii) Any distilled spirits (beverage alcohols), wine, or malt beverage intended for nonindustrial use, as such terms are defined in the Federal Alcohol Administration Act (27 U.S.C. 201 *et seq.*) and regulations issued under that Act, when subject to the labeling requirements of that Act and labeling regulations issued under that Act by the Bureau of Alcohol Tobacco, and Firearms; and,

(iv) Any consumer product or hazardous substance as those terms are defined in the Consumer Product Safety Act (15 U.S.C. 2051 *et seq.*) and Federal Hazardous Substances Act (15 U.S.C. 1261 *et seq.*) respectively, when subject to a consumer product safety standard or labeling requirement of those Acts, or regulations issued under those Acts by the Consumer Product Safety Commission.

(6) This section does not apply to:

(i) Any hazardous waste as such term is defined by the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. 6901 *et seq.*), when subject to regulations issued under that Act by the Environmental Protection Agency;

(ii) Tobacco or tobacco products;

(iii) Wood or wood products;

(iv) Articles;

(v) Food, drugs, cosmetics, or alcoholic beverages in a retail establishment which are packaged for sale to consumers;

(vi) Foods, drugs, or cosmetics intended for personal consumption by employees while in the workplace;

(vii) Any consumer product or hazardous substance, as those terms are defined in the Consumer Product Safety Act (15 U.S.C. 2051 *et seq.*) and Federal Hazardous Substances Act (15 U.S.C. 1261 *et seq.*) respectively, where the employer can demonstrate it is used in the workplace in the same manner as normal consumer use, and which use results in a duration and frequency of exposure which is not greater than exposures experienced by consumers; and,

(viii) Any drug, as that term is defined in the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 301 *et seq.*), when it is in solid, final form for direct administration to the patient (i.e. tablets or pills).

(c) *Definitions.*

Article means a manufactured item: (i) Which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii)

which does not release, or otherwise result in exposure to, a hazardous chemical, under normal conditions of use.

Assistant Secretary means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

Chemical means any element, chemical compound or mixture of elements and/or compounds.

Chemical manufacturer means an employer with a workplace where chemical(s) are produced for use or distribution.

Chemical name means the scientific designation of a chemical in accordance with the nomenclature system developed by the International Union of Pure and Applied Chemistry (IUPAC) or the Chemical Abstracts Service (CAS) rules of nomenclature, or a name which will clearly identify the chemical for the purpose of conducting a hazard evaluation.

Combustible liquid means any liquid having a flashpoint at or above 100°F (37.8°C), but below 20°F (93.3°C), except any mixture having components with flashpoints of 200°F (93.3°C), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.

Common name means any designation or identification such as code name, code number, trade name, brand name or generic name used to identify a chemical other than by its chemical name.

Compressed gas means:

(i) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70°F (21.1°C); or

(ii) a gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130°F (54.4°C) regardless of the pressure at 70°F (21°C); or

(iii) A liquid having a vapor pressure exceeding 40 psi at 100°F (37.8°C) as determined by ASTM D-323-72.

Container means any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or the like that contains a hazardous chemical. For purposes of this section, pipes or piping systems, and engines, fuel tanks, or other operating systems in a vehicle, are not considered to be containers.

Designated representative means any individual or organization to whom an employee gives written authorization to exercise such employees rights under this section. A recognized or certified collective bargaining agent shall be treated automatically as a designated representative without regard to written employee authorization.

Director means the Director, National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

(3) Significant dental changes; i.e., multiple extractions without prostheses, or acquiring dentures.

(4) Reconstructive or cosmetic surgery, or

(5) Any other condition that may interfere with facepiece sealing.

11. *Recordkeeping.* a. A summary of all test results shall be maintained for three years. The summary shall include:

(1) Name of test subject.

(2) Date of testing.

(3) Name of the test conductor.

(4) Fit factors obtained from every respirator tested (indicate manufacturer, model, size and approval number).

b. A copy of all test data including the strip chart and results shall be kept for at least five years.

§1910.1200 Hazard communication.

(a) *Purpose.* (1) The purpose of this section is to ensure that the hazards of all chemicals produced or imported are evaluated, and that information concerning their hazards is transmitted to employers and employees. This transmittal of information is to be accomplished by means of comprehensive hazard communication programs, which are to include container labeling and other forms of warning, material safety data sheets and employee training.

(2) This occupational safety and health standard is intended to address comprehensively the issue of evaluating the potential hazards of chemicals, and communicating information concerning hazards and appropriate protective measures to employees, and to preempt any legal requirements of a state, or political subdivision of a state, pertaining to the subject. Evaluating the potential hazards of chemicals, and communicating information concerning hazards and appropriate protective measures to employees, may include, for example, but is not limited to, provisions for: developing and maintaining a written hazard communication program for the workplace, including lists of hazardous chemicals present; labeling of containers of chemicals in the workplace, as well as of containers of chemicals being shipped to other workplaces; preparation and distribution of material safety data sheets to employees and downstream employers; and development and implementation of employee training programs regarding hazards of chemicals and protective measures. Under section 18 of the Act, no state or political subdivision of a state may adopt or enforce, through any court or agency, any requirement relating to the issue addressed by this Federal standard, except pursuant to a Federally-approved state plan.

(b) *Scope and application.* (1) This section requires chemical manufacturers or importers to assess the hazards of chemicals which they produce or import, and all employers to provide information to their employees about the hazardous chemicals to which they are exposed, by means of a hazard communication program, labels and other forms of warning, material safety data sheets, and information and training. In addition, this section requires distributors to transmit the required information to employers.

(2) This section applies to any chemical which is known to be present in the workplace in such a manner that employees may be exposed under normal conditions of use or in a foreseeable emergency.

(3) This section applies to laboratories only as follows:

(i) Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced;

(ii) Employers shall maintain any material safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible to laboratory employees; and,

(iii) Employers shall ensure that laboratory employees are apprised of the hazards of the chemicals in their workplaces in accordance with paragraph (h) of this section.

(4) In work operations where employees only handle chemicals in sealed containers which are not opened under normal conditions of use (such as are found in marine cargo handling, warehousing, or retail sales), this section applies to these operations only as follows:

(i) Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced;

(ii) Employers shall maintain copies of any material safety data sheets that are received with incoming shipments of the sealed containers of hazardous chemicals, shall obtain a material safety data sheet for sealed containers of hazardous chemicals received without a material safety data sheet if an employee requests the material safety data sheet, and shall ensure that the material safety data sheets are readily accessible during each work shift to employees when they are in their work area(s); and,

(iii) Employers shall ensure that employees are provided with information and training in accordance with paragraph (h) of this section (except for the location and availability of the written hazard communication program under paragraph (h)(1)(iii)), to the extent necessary to protect them in the event of a spill or leak of a hazardous chemical from a sealed container.

(5) This section does not require labeling of the following chemicals:

(i) Any pesticide as such term is defined in the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136 *et seq.*), when subject to the labeling requirements of that Act and labeling regulations issued under that Act by the Environmental Protection Agency;

(ii) Any food, food additive, color additive, drug, cosmetic, or medical or veterinary device, including materials intended for use as ingredients in such products (e.g. flavors and fragrances), as such terms are defined in the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 301 *et*

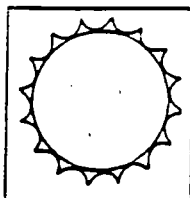
Appendix D
Hazard Communication Standard
(29 CFR 1910.1200)

CHAPTER 8 HEAT STRESS AND COLD EXPOSURE

8.0 INTRODUCTION

Temperature extremes pose a hazard of particular concern to the health, safety, and comfort of personnel involved in hazardous waste site activities. Site health and safety personnel must consider the two most common dangers, heat stress and cold exposure, when making decisions regarding PPE selection and work mission duration, when establishing standard operating procedures for site activities, and when conducting medical monitoring.

8.1 HEAT STRESS



Heat stress is one of the most common and potentially serious illnesses at hazardous waste sites and, therefore, warrants regular monitoring and other preventive measures.

Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, and the individual characteristics of the worker. Depending on the ambient conditions and the work being performed, heat stress can occur very rapidly -- within as little as 15 minutes -- and can pose as great a danger to worker health as chemical exposure. In its early stages, heat stress can cause rashes, cramps, and drowsiness. This can result in impaired functional ability that threatens the safety of both the individual and co-workers. Continued heat stress can lead to heat stroke and death.

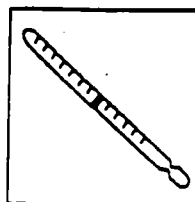
8.1.1 Heat Stress and PPE

Heat stress is a major health hazard for workers wearing PPE because the same protective materials that shield the body from chemical exposure also limit the dissipation of body heat and moisture. Thus, personal protective clothing can create a hazardous condition.

Reduced work tolerance and the increased risk of excessive heat stress is directly influenced by the amount and type of PPE worn. The added weight and bulk of PPE severely reduces the body's access to normal heat exchange mechanisms and

increases energy expenditure. When selecting PPE, therefore, each item's benefit should be carefully evaluated in relation to its potential for increasing the risk of heat stress. After PPE has been selected, the safe duration of work/rest periods should be determined based on the anticipated work rate, the ambient temperature and other environmental factors, the type of protective ensemble, and the individual worker characteristics and fitness.

8.1.2 Monitoring for Heat Stress



All workers, even those not wearing protective equipment, should be monitored, because the incidence of heat stress depends on a variety of factors and can affect any worker.

Monitoring should be initiated before initial entry and should be continued during each break cycle. Some general guidelines include:

- For workers wearing permeable clothing, monitor for signs of heat stress and follow established work/rest schedules.
- For workers wearing semipermeable or impermeable encapsulating ensembles, workers should also be monitored when the temperature in the work area is above 70°F (21°C). Below 70°F, monitoring is considered on a case-by-case basis.

To conduct personnel monitoring, measure the heart rate and body temperature, as follows:

Heart Rate. Count the radial pulse during a 30-second period as early as possible in the rest period. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same. If the heart rate still exceeds 110 beats per minute at the next rest period, shorten the following work cycle by one-third.

Oral Temperature. Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking). If

EXHIBIT 8-1
Suggested Frequency of Physiological Monitoring for Fit and Acclimatized Workers^a

ADJUSTED TEMPERATURE ^b	NORMAL WORK ENSEMBLE ^c	IMPERMEABLE ENSEMBLE
90°F (32.2°) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°- 90°F (30.8°- 32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°- 87.5°F (28.1°- 30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°- 82.5°F (25.3°- 28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°-77.5°F (22.5°-25.3°C)	After each 150 minutes of work	After each 120 minutes of work

^a For work levels of 250 kilocalories/hour.

^b Calculate the adjusted air temperature (ta adj) by using this equation: $ta\ adj\ ^\circ F = ta\ ^\circ F + (13 \times \% \text{ sunshine})$. Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)

^c A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

Source: *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities* (NIOSH/OSHA/USCG/EPA, 1985).

oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one-third without changing the rest period. If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following work cycle by one-third. Do not permit a worker to wear a semipermeable or impermeable garment when his/her oral temperature exceeds 100.6°F (38.1°C).

Initially, the length of the work cycle should be governed by the frequency of the required physiological monitoring. The frequency of physiological monitoring depends on the air temperature adjusted for solar radiation and the level of physical work (see Exhibit 8-1, above).

8.1.3 Preventing Heat Stress

To protect against heat stress, it is important to choose the appropriate level of protection, to provide careful training for workers and site personnel, and to monitor frequently personnel who wear protective clothing. It is also important to ensure that work and rest periods are scheduled regularly, and that workers frequently replace lost fluids (it is not uncommon for workers to lose as many as 6 to 8 quarts of water in a hot shift).

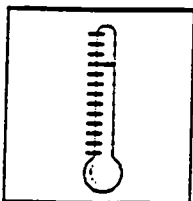
Proper training and preventive measures will help avert serious illness and loss of work productivity caused by heat stress. Preventing heat stress is particularly important because one incident of heat stress will increase the likelihood of future incidences. The site health and safety officer should take the following steps to prevent heat stress:

- Adjust work and rest schedules as needed;
- Provide shelter or shaded areas to protect personnel during rest periods;
- Maintain workers' body fluids at normal levels to ensure that the cardiovascular system functions adequately. Daily fluid intake must equal the approximate amount of water lost in sweat;
- Encourage workers to maintain an optimal level of physical fitness. Fit individuals may acclimatize more readily to temperatures;
- Provide cooling devices to aid natural body heat exchange during prolonged work or severe heat exposure. Effective devices

include field showers or hose-down areas, as well as cooling jackets, vests, or suits;

- Train workers to recognize and treat heat stress, and to identify the signs and symptoms of heat stress (e.g., muscle spasms, dizziness, lack of perspiration). Refer to Exhibit 8-2 for more detail on the signs and symptoms of heat stress.

8.2 COLD EXPOSURE



Exposure to cold temperatures can cause frostbite and hypothermia as well as impair the ability to work. Extremely low temperatures are not necessary to suffer cold exposure -- a strong wind

combined with a cold temperature can chill the body to the point where frostbite and hypothermia are a risk. Maintaining body temperature and recognizing the early signs and symptoms can help prevent illness and injury due to cold exposure.

Cold injury is generally classified as local (e.g., frostbite or frostnip) or general (e.g., hypothermia). The main factors contributing to cold injury are exposure to humidity and high winds, contact with wetness or metal, inadequate clothing, age, and general health. Physical conditions that worsen the effects of cold include allergies, vascular disease, excessive smoking and drinking, and use of specific drugs and medicines.

8.2.1 PPE And Cold Exposure

The correct PPE depends on the specific cold stress situation. It is important to preserve the air space between the body and the outer layer of clothing in order to retain body heat. The more air pockets each layer of clothing has, the better the insulation. However, the insulating effect is negated if the clothing interferes with the evaporation of sweat, or if the skin or clothing is wet.

The most important parts of the body to protect are the feet, hands, head, and face. Hands and feet are the farthest from the heart, and become cooled most easily. Keeping the head covered is important, because as much as 40 percent of body heat can be lost when the head is exposed.

Workers should wear several layers of clothing instead of a single heavy outer garment. In addition to offering better insulation, layers of clothing can be removed as needed to keep the worker from overheating. The outer layer should be windproof as well as waterproof, because body heat is lost quickly in even light winds.

8.2.2 Monitoring for Cold Exposure

Recognizing the early signs and symptoms of cold stress can help prevent serious injury. Described below are the most common types of cold injury and their monitoring signals.

Hypothermia. The first symptoms of hypothermia are uncontrollable shivering and the sensation of cold; the heartbeat slows and sometimes becomes irregular, the pulse weakens, and the blood pressure changes. Severe shaking or rigid muscles may be caused by bursts of body energy and changes in the body's chemistry. Uncontrollable fits of shivering, vague or slow slurred speech, memory lapses, incoherence and drowsiness are some of the symptoms that can occur. Other symptoms that can be seen before complete collapse are cool skin, slow and irregular breathing, low blood pressure, apparent exhaustion, and fatigue after rest.

As the core body temperature drops, the victim may become listless, confused, and make little or no attempt to keep warm. Pain in the extremities can be the first warning of dangerous exposure to cold. Severe shivering must be taken as a sign of danger. If the body core temperature reaches about 85°F, significant and dangerous drops in blood pressure, pulse rate, and respiration can occur. In some cases, the victim may die.

Frostbite. Frostbite can occur without hypothermia when the extremities do not receive sufficient heat from central body stores. This can occur because of inadequate circulation and/or insulation. Frostbite occurs when there is freezing of the fluids around the cells of the body tissues due to extremely low temperatures. Frostbite may result in damage to and loss of tissue, and usually affects the nose, cheeks, ears, fingers, and toes. Damage from frostbite can be serious (e.g., scarring, tissue death resulting in amputation, and permanent loss of movement in the affected parts).

EXHIBIT 8-2
Classification, Medical Aspects, and Prevention of Heat Illness

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Category and Clinical Features	Predisposing Factors	Underlying Physiological Disturbance	Treatment	Prevention
Temperature Regulation Heatstroke				
Heatstroke: (1) Hot, dry skin; usually red, mottled, or cyanotic; (2) rectal temperature 40.5°C (104°F) and over; (3) confusion, loss of consciousness, convulsions, rectal temperature continues to rise; fatal if treatment is delayed	(1) Sustained exertion in heat by unacclimatized workers; (2) lack of physical fitness and obesity; (3) recent alcohol intake; (4) dehydration; (5) individual susceptibility; and (6) chronic cardiovascular disease	Failure of the central drive for sweating (cause unknown) leading to loss of evaporative cooling and an uncontrolled accelerating rise in t_{re} ; there may be partial rather than complete failure of sweating	Immediate and rapid cooling by immersion in chilled water with massage or by wrapping in wet sheet with vigorous fanning with cool dry air; avoid overcooling; treat shock if present	Medical screening of workers, selection based on health and physical fitness; acclimatization for 5-7 days by graded work and heat exposure; monitoring workers during sustained work in severe heat
Circulatory Hypostasis Heat Syncope				
Fainting while standing erect and immobile in heat	Lack of acclimatization	Pooling of blood in dilated vessels of skin and lower parts of body	Remove to cooler area; rest in recumbent position; recovery prompt and complete	Acclimatization; intermittent activity to assist venous return to heart
Water and/or Salt Depletion				
(a) Heat Exhaustion				
(1) Fatigue, nausea, headache, giddiness; (2) skin clammy and moist; complexion pale, muddy, or hectic flush; (3) may faint on standing with rapid thready pulse and low blood pressure; (4) oral temperature normal or low, but rectal temperature usually elevated (37.5-38.5°C or 99.5-101.3°F); water restriction type: urine volume small, highly concentrated; salt restriction type: urine less concentrated chlorides less than 3 g/L	(1) Sustained exertion in heat; (2) lack of acclimatization; and (3) failure to replace water lost in sweat	(1) Dehydration from deficiency of water; (2) depletion of circulating blood volume; (3) circulatory strain from competing demands for blood flow to skin and to active muscles	Remove to cooler environment; rest in recumbent position; administer fluids by mouth; keep at rest until urine volume indicates that water balances have been restored	Acclimatize workers using a breaking-in schedule for 5-7 days; supplement dietary salt only during acclimatization; ample drinking water to be available at all times and to be taken frequently during work day
(b) Heat Cramps				
Painful spasms of muscles used during work (arms, legs, or abdominal); onset during or after work hours	(1) Heavy sweating during hot work; (2) drinking large volumes of water without replacing salt loss	Loss of body salt in sweat, water intake dilutes electrolytes; water enters muscles, causing spasm	Salted liquids by mouth, or more prompt relief by IV infusion	Adequate salt intake with meals; for unacclimatized workers, supplement salt intake at meals.

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EXHIBIT 8-2 (continued)
Classification, Medical Aspects, and Prevention of Heat Illness

Category and Clinical Features	Predisposing Factors	Underlying Physiological Disturbance	Treatment	Prevention
Skin Eruptions				
(a) <u>Heat Rash</u> (<i>millaria rubra</i> , or "prickly heat")				
Profuse tiny raised red vesicles (blister-like) on affected areas; pricking sensations during heat exposure	Unrelieved exposure to humid heat with skin continuously wet from unevaporated sweat	Plugging of sweat gland ducts with sweat retention and inflammatory reaction	Mild drying lotions; skin cleanliness to prevent infection	Cool sleeping quarters to allow skin to dry between heat exposures
(b) <u>Anhidrotic Heat Exhaustion</u> (<i>millaria profunda</i>)				
Extensive areas of skin which do not sweat on heat exposure, but present gooseflesh appearance, which subsides with cool environments; associated with incapacitation in heat	Weeks or months of constant exposure to climatic heat with previous history of extensive heat rash and sunburn	Skin trauma (heat rash; sunburn) causes sweat retention deep in skin; reduced evaporative cooling causes heat intolerance	No effective treatment available for anhidrotic areas of skin; recovery of sweating occurs gradually on return to cooler climate	Treat heat rash and avoid further skin trauma by sunburn; provide periodic relief from sustained heat
Behavioral Disorders				
(a) <u>Heat Fatigue - Transient</u>				
Impaired performance of skilled sensorimotor, mental, or vigilance tasks, in heat	Performance decrement greater in unacclimatized and unskilled worker	Discomfort and physiologic strain	Not indicated unless accompanied by other heat illness	Acclimatization and training for work in the heat
(b) <u>Heat Fatigue - Chronic</u>				
Reduced performance capacity; lowering of self-imposed standards of social behavior (e.g., alcoholic over-indulgence); inability to concentrate, etc.	Workers at risk come from temperate climates for long residence in tropical latitudes	Psychosocial stresses probably as important as heat stress; may involve hormonal imbalance but no positive evidence	Medical treatment for serious causes; speedy relief of symptoms on returning home	Orientation on life in hot regions (customs, climate, living conditions, etc.)

The freezing point of the skin is about 30°F (-1°C). As wind velocity increases, heat loss is greater and frostbite will occur more rapidly. If skin comes into contact with objects colder than freezing (e.g., tools or machinery), frostbite may develop at the point of contact, even in warmer environments.

There are three degrees of frostbite: first degree, which is freezing without blistering or peeling; second degree, which is freezing with blistering or peeling; and third degree, which is freezing with tissue death. Exhibit 8-3 lists the symptoms of frostbite. It is important to remember that the victim is often unaware of the frostbite until someone else observes the symptoms.

EXHIBIT 8-3 Symptoms of Frostbite

- The first symptom of frostbite is an uncomfortable sensation of coldness, followed by numbness. There may be tingling, stinging, aching, or cramping.
- The skin changes color to white or grayish-yellow, then to reddish-violet, and finally turns black as the tissue dies.
- Pain may be felt at first, but subsides.
- Blisters may appear.
- The affected part is cold and numb.
- When frostbite of the outer layer of skin occurs, the skin has a waxy or whitish look and is firm to the touch.
- In cases of deep frostbite, the tissues are cold, pale, and solid. Injury is severe.

8.2.3 Preventing Cold Exposure

In preventing cold stress, health and safety professionals must consider factors relating both to the individual and to the environment. Acclimatization, water and salt replacement, medical screening, continuing medical supervision, proper work clothing, and training and education will contribute to the prevention of cold stress and injury related to working in a cold environment. Control of the environment involves engineering controls, work practices, work-rest schedules,

environmental monitoring, and considerations of windchill temperature.

Acclimatization. Some degree of acclimatization may be achieved in cold environments. With sufficient exposure to cold, the body undergoes some changes that increase comfort and reduce the risk of cold injury. However, these physiological changes are usually minor and require repeated uncomfortably cold exposures to induce them. People who are physically unfit, older, obese, taking medication, or using alcohol or drugs may not acclimatize too readily.

Dehydration. Working in cold areas causes significant water losses through the skin and lungs as a result of the dryness of the air. Increased fluid intake is essential to prevent dehydration, which affects the flow of blood to the extremities and increased the risk of cold injury. Warm, sweet, caffeine-free, non-alcoholic drinks and soup should be available at the work-site for fluid replacement and caloric energy.

Salt. The body needs a certain amount of salt and other electrolytes to function properly. However, using salt tablets is not recommended. Salt tablets cause stomach irritation, which may include nausea and vomiting. A normal, balanced diet should take care of salt needs. Anyone with high blood pressure or who is on a restricted sodium diet should consult a physician for advice on salt intake.

Windchill. Air temperature alone is not sufficient to judge the cold hazard of a particular environment, because even a light wind can blow away the thin layer of air that insulates the body against the cold air temperature. The "windchill factor" is the cooling effect of any combination of temperature and air movement. The windchill index (Exhibit 8-4) should be consulted to estimate the equivalent temperature felt by personnel working in cold and windy environments. Remember, however, that the windchill index does not take into account: (1) the body part exposed to the cold; (2) the level of activity and the resulting heat produced; or (3) the amount of clothing worn.

Continuous exposure of skin should not be permitted when the windchill factor results in an equivalent temperature of -32°C (-26°F). Workers exposed to air temperatures of 2°C (35.6°F) or lower who become immersed in water or whose

EXHIBIT 8-4
Windchill Index¹

	ACTUAL THERMOMETER READING (F)									
	50	40	30	20	10	0	-10	-20	-30	-40
Wind speed in mph	EQUIVALENT TEMPERATURE (F)									
calm	50	40	30	20	10	0	-10	-20	-30	-40
5	48	37	27	16	6	-5	-15	-26	-36	-47
10	40	28	16	4	-9	-21	-33	-46	-58	-70
15	36	22	9	-5	-18	-36	-45	-58	-72	-85
20	32	18	4	-10	-25	-39	-53	-67	-82	-96
25	30	16	0	-15	-29	-44	-59	-74	-88	-104
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109
35	27	11	-4	-20	-35	-49	-67	-82	-98	-113
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116
Over 40 mph (little added effect)	Little Danger (for properly clothed person)			Increasing Danger (Danger from freezing of exposed flesh)				Great Danger		

¹Source: *Fundamentals of Industrial Hygiene, Third Edition*. Plog, B.A., Benjamin, G.S., Kerwin, M.A., National Safety Council, 1988.

clothing gets wet should be given dry clothing and be treated for hypothermia.

Special Considerations. Older workers and workers with circulatory problems need to be extra careful in the cold. Additional insulating clothing and reduced exposure time should be considered for these workers. Obese and chronically ill people need to make a special effort to follow preventive measures. Sufficient sleep and good nutrition are important for maintaining a high level of tolerance to cold. If possible, the most stressful tasks should be performed during the warmer parts of the day. Double shifts and overtime should be avoided. Rest periods should be extended to cope with increases in cold stress.

Workers should immediately go to warm shelter if any of the following symptoms are spotted: the onset of heavy shivering, frostnip, the feeling of excessive fatigue, drowsiness, and/or euphoria. The outer layer of clothing should be removed when entering a heated shelter. If possible, a change of dry work clothing should be provided to prevent workers from returning to

work with wet clothing. If this is not feasible, the remaining clothing should be loosened to permit sweat to evaporate.

Alcohol should not be consumed while in the warmer environment. Anyone on medication such as blood pressure control or water pills should consult a physician about possible side effects from cold stress. It is strongly recommended that workers suffering from diseases or taking medication that interferes with normal body temperature regulation, or that reduces tolerance of cold, not be permitted to work in temperatures of -1°C (30°F) or below.

To guard against cold exposure, provide workers with appropriate clothing, have warm shelter available at all times, carefully schedule work and rest periods, and monitor workers' physical conditions. Under no circumstances should a person be given an alcoholic beverage "to keep warm." Alcohol causes the body to release heat more quickly and will therefore increase the risk of cold exposure. Fruits can help warm the body by creating increased energy and metabolism.

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8.2.4 A Control Program for Cold Stress

A control program for preventing cold stress at hazardous waste sites should include the following elements:

- **Medical supervision of workers** including pre-placement physicals that evaluate fitness, weight, the cardiovascular system, and other conditions that might make workers susceptible to cold stress. Medical evaluation during and after cold illnesses and a medical release for returning to work should be required.
- **Employee orientation and training** on cold stress, cold-induced illnesses and their symptoms, water and air replacement, proper clothing, work practices, and emergency first aid procedures.
- **Work-rest regimens**, with heated rest areas and enforced rest breaks.
- **Scheduled drink breaks** for recommended fluids.
- **Environmental monitoring**, using the air temperature and wind speed indices to determine wind chill and adjust work/rest schedules accordingly.
- **Reduction of cold stress** through engineering and administrative controls, and the use of personal protective equipment.

FURTHER GUIDANCE: For additional information on recognizing, preventing, and controlling heat and cold stress, see:

1. Plog, Barbara A., Benjamin, G.S., and M.A. Kerwin. *Fundamentals of Industrial Hygiene, Third Edition*. National Safety Council, 1988.
2. *Pocket Guide to Cold Stress*. National Safety Council, 1985.
3. *Pocket Guide to Heat Stress*. National Safety Council, 1985.
4. *1991-1992 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*. American Conference of Governmental Industrial Hygienists, 1991.

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Appendix E
Lead Standard
(29 CFR 1910.1025)

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OSHA Regulations (Standards - 29 CFR)

Lead. - 1910.1025

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- **Standard Number:** 1910.1025
- **Standard Title:** Lead.
- **SubPart Number:** Z
- **SubPart Title:** Toxic and Hazardous Substances
- **Applicable Standard:** Applicable Standard:

Interpretation(s)

(a)

Scope and application.

(a)(1)

This section applies to all occupational exposure to lead, except as provided in paragraph (a)(2).

(a)(2)

This section does not apply to the construction industry or to agricultural operations covered by 29 CFR Part 1928.

(b)

Definitions.

"Action level" means employee exposure, without regard to the use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air (30 ug/m(3)) averaged over an 8-hour period.

"Assistant Secretary" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

"Director" means the Director, National Institute for Occupational Safety and Health (NIOSH), U.S. Department of Health, Education, and Welfare, or designee.

"Lead" means metallic lead, all inorganic lead compounds, and organic lead soaps. Excluded from this definition are all other organic lead compounds.

(c)

Permissible exposure limit (PEL).

(c)(1)

The employer shall assure that no employee is exposed to lead at concentrations greater than fifty micrograms per cubic meter of air (50 ug/m(3)) averaged over an 8-hour period.

(c)(2)

If an employee is exposed to lead for more than 8 hours in any work day, the permissible exposure limit, as a time weighted average (TWA) for that day, shall be reduced according to the following formula:

Maximum permissible limit (in ug/m(3))=400 divided by hours worked in the day.

..1910.1025(c)(3)**(c)(3)**

When respirators are used to supplement engineering and work practice controls to comply with the PEL and all the requirements of paragraph (f) have been met, employee exposure, for the purpose of determining whether the employer has complied with the PEL, may be considered to be at the level provided by the protection factor of the respirator for those periods the respirator is worn. Those periods may be averaged with exposure levels during periods when respirators are not worn to determine the employee's daily TWA exposure.

(d)

Exposure monitoring -

(d)(1)

General.

(d)(1)(i)

For the purposes of paragraph (d), employee exposure is that exposure which would occur if the employee were not using a respirator.

(d)(1)(ii)

With the exception of monitoring under paragraph (d)(3), the employer shall collect full shift (for at least 7 continuous hours) personal samples including at least one sample for each shift for each job classification in each work area.

(d)(1)(iii)

Full shift personal samples shall be representative of the monitored employee's regular, daily exposure to lead.

(d)(2)

Initial determination. Each employer who has a workplace or work operation covered by this standard shall determine if any employee may be exposed to lead at or above the action level.

(d)(3)

Basis of initial determination.

(d)(3)(i)

The employer shall monitor employee exposures and shall base initial determinations on the employee exposure monitoring results and any of the following, relevant considerations:

..1910.1025(d)(3)(i)(A)

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(d)(3)(i)(A)

Any information, observations, or calculations which would indicate employee exposure to lead;

(d)(3)(i)(B)

Any previous measurements of airborne lead; and

(d)(3)(i)(C)

Any employee complaints of symptoms which may be attributable to exposure to lead.

(d)(3)(ii)

Monitoring for the initial determination may be limited to a representative sample of the exposed employees who the employer reasonably believes are exposed to the greatest airborne concentrations of lead in the workplace.

(d)(3)(iii)

Measurements of airborne lead made in the preceding 12 months may be used to satisfy the requirement to monitor under paragraph (d)(3)(i) if the sampling and analytical methods used meet the accuracy and confidence levels of paragraph (d)(9) of this section.

(d)(4)

Positive initial determination and initial monitoring.

(d)(4)(i)

Where a determination conducted under paragraphs (d)(2) and (3) of this section shows the possibility of any employee exposure at or above the action level, the employer shall conduct monitoring which is representative of the exposure for each employee in the workplace who is exposed to lead.

..1910.1025(d)(4)(ii)**(d)(4)(ii)**

Measurements of airborne lead made in the preceding 12 months may be used to satisfy this requirement if the sampling and analytical methods used meet the accuracy and confidence levels of paragraph (d)(9) of this section.

(d)(5)

Negative initial determination. Where a determination, conducted under paragraphs (d)(2) and (3) of this section is made that no employee is exposed to airborne concentrations of lead at or above the action level, the employer shall make a written record of such determination. The record shall include at least the information specified in paragraph (d)(3) of this section and shall also include the date of determination, location within the worksite, and the name and social security number of each employee monitored.

(d)(6)

Frequency.

(d)(6)(i)

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If the initial monitoring reveals employee exposure to be below the action level the measurements need not be repeated except as otherwise provided in paragraph (d)(7) of this section.

(d)(6)(ii)

If the initial determination or subsequent monitoring reveals employee exposure to be at or above the action level but below the permissible exposure limit the employer shall repeat monitoring in accordance with this paragraph at least every 6 months. The employer shall continue monitoring at the required frequency until at least two consecutive measurements, taken at least 7 days apart, are below the action level at which time the employer may discontinue monitoring for that employee except as otherwise provided in paragraph (d)(7) of this section.

..1910.1025(d)(6)(iii)**(d)(6)(iii)**

If the initial monitoring reveals that employee exposure is above the permissible exposure limit the employer shall repeat monitoring quarterly. The employer shall continue monitoring at the required frequency until at least two consecutive measurements, taken at least 7 days apart, are below the PEL but at or above the action level at which time the employer shall repeat monitoring for that employee at the frequency specified in paragraph (d)(6)(ii), except as otherwise provided in paragraph (d)(7) of this section.

(d)(7)

Additional monitoring. Whenever there has been a production, process, control or personnel change which may result in new or additional exposure to lead, or whenever the employer has any other reason to suspect a change which may result in new or additional exposures to lead, additional monitoring in accordance with this paragraph shall be conducted.

(d)(8)

Employee notification.

(d)(8)(i)

Within 5 working days after the receipt of monitoring results, the employer shall notify each employee in writing of the results which represent that employee's exposure.

(d)(8)(ii)

Whenever the results indicate that the representative employee exposure, without regard to respirators, exceeds the permissible exposure limit, the employer shall include in the written notice a statement that the permissible exposure limit was exceeded and a description of the corrective action taken or to be taken to reduce exposure to or below the permissible exposure limit.

..1910.1025(d)(9)**(d)(9)**

Accuracy of measurement. The employer shall use a method of monitoring and analysis which has an accuracy (to a confidence level of 95%) of not less than plus or minus 20 percent for airborne concentrations of lead equal to or greater than 30 ug/m(3).

(e)

Methods of compliance -

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(e)(1)

Engineering and work practice controls.

(e)(1)(i)

Where any employee is exposed to lead above the permissible exposure limit for more than 30 days per year, the employer shall implement engineering and work practice controls (including administrative controls) to reduce and maintain employee exposure to lead in accordance with the implementation schedule in Table I below, except to the extent that the employer can demonstrate that such controls are not feasible. Wherever the engineering and work practice controls which can be instituted are not sufficient to reduce employee exposure to or below the permissible exposure limit, the employer shall nonetheless use them to reduce exposures to the lowest feasible level and shall supplement them by the use of respiratory protection which complies with the requirements of paragraph (f) of this section.

(e)(1)(ii)

Where any employee is exposed to lead above the permissible exposure limit, but for 30 days or less per year, the employer shall implement engineering controls to reduce exposures to 200 ug/m(3), but thereafter may implement any combination of engineering, work practice (including administrative controls), and respiratory controls to reduce and maintain employee exposure to lead to or below 50 ug/m(3)

TABLE I

Industry	Compliance dates(1): (50 UG/M(3))
Lead chemicals, secondary copper smelting.	July 19, 1996.
Nonferrous foundries	July 19, 1996(2).
Brass and bronze ingot manufacture.....	6 years(3).

Footnote(1) Calculated by counting from the date the stay on implementation of paragraph (e)(1) was lifted by the U.S. Court of Appeals for the District of Columbia, the number of years specified in the 1978 lead standard and subsequent amendments for compliance with the PEL of 50 ug/m(3) for exposure to airborne concentrations of lead levels for the particular industry.

Footnote(2) Large nonferrous foundries (20 or more employees) are required to achieve the PEL of 50 ug/m(3) by means of engineering and work practice controls. Small nonferrous foundries (fewer than 20 employees) are required to achieve an 8-hour TWA of 75 ug/m(3) by such controls.

Footnote(3) Expressed as the number of years from the date on which the Court lifts the stay on the implementation of paragraph (e)(1) for this industry for employers to achieve a lead in air concentration of 75 ug/m(3). Compliance with paragraph (e) in this industry is determined by a compliance directive that incorporates elements from the settlement agreement between OSHA and representatives of the injury. are required to comply within five years.

..1910.1025(e)(2)**(e)(2)**

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Respiratory protection. Where engineering and work practice controls do not reduce employee exposure to or below the 50 ug/m(3) permissible exposure limit, the employer shall supplement these controls with respirators in accordance with paragraph (f).

(e)(3)

Compliance program.

(e)(3)(i)

Each employer shall establish and implement a written compliance program to reduce exposures to or below the permissible exposure limit, and interim levels if applicable, solely by means of engineering and work practice controls in accordance with the implementation schedule in paragraph (e)(1).

(e)(3)(ii)

Written plans for these compliance programs shall include at least the following:

(e)(3)(ii)(A)

A description of each operation in which lead is emitted; e.g. machinery used, material processed, controls in place, crew size, employee job responsibilities, operating procedures and maintenance practices;

(e)(3)(ii)(B)

A description of the specific means that will be employed to achieve compliance, including engineering plans and studies used to determine methods selected for controlling exposure to lead;

(e)(3)(ii)(C)

A report of the technology considered in meeting the permissible exposure limit;

(e)(3)(ii)(D)

Air monitoring data which documents the source of lead emissions;

..1910.1025(e)(3)(ii)(E)**(e)(3)(ii)(E)**

A detailed schedule for implementation of the program, including documentation such as copies of purchase orders for equipment, construction contracts, etc.;

(e)(3)(ii)(F)

A work practice program which includes items required under paragraphs (g), (h) and (i) of this regulation;

(e)(3)(ii)(G)

An administrative control schedule required by paragraph (e)(6), if applicable;

(e)(3)(ii)(H)

Other relevant information.

(e)(3)(iii)

Written programs shall be submitted upon request to the Assistant Secretary and the

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Director, and shall be available at the worksite for examination and copying by the Assistant Secretary, Director, any affected employee or authorized employee representatives.

(e)(3)(iv)

Written programs shall be revised and updated at least every 6 months to reflect the current status of the program.

..1910.1025(e)(4)

(e)(4)

Mechanical ventilation.

(e)(4)(i)

When ventilation is used to control exposure, measurements which demonstrate the effectiveness of the system in controlling exposure, such as capture velocity, duct velocity, or static pressure shall be made at least every 3 months. Measurements of the system's effectiveness in controlling exposure shall be made within 5 days of any change in production, process, or control which might result in a change in employee exposure to lead.

(e)(4)(ii)

Recirculation of air. If air from exhaust ventilation is recirculated into the workplace, the employer shall assure that (A) the system has a high efficiency filter with reliable back-up filter; and (B) controls to monitor the concentration of lead in the return air and to bypass the recirculation system automatically if it fails are installed, operating, and maintained.

(e)(5)

Administrative controls. If administrative controls are used as a means of reducing employees TWA exposure to lead, the employer shall establish and implement a job rotation schedule which includes:

(e)(5)(i)

Name or identification number of each affected employee;

(e)(5)(ii)

Duration and exposure levels at each job or work station where each affected employee is located; and

(e)(5)(iii)

Any other information which may be useful in assessing the reliability of administrative controls to reduce exposure to lead.

(f)

Respiratory protection.

(f)(1)

General. For employees who use respirators required by this section, the employer must provide respirators that comply with the requirements of this paragraph. Respirators must be used during:

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(f)(1)(i)

Periods necessary to install or implement engineering or work-practice controls.

(f)(1)(ii)

Work operations for which engineering and work-practice controls are not sufficient to reduce employee exposures to or below the permissible exposure limit.

..1910.1025(f)(1)(iii)**(f)(1)(iii)**

Periods when an employee requests a respirator.

(f)(2)***Respirator program.*****(f)(2)(i)**

The employer must implement a respiratory protection program in accordance with 29 CFR 1910.134 (b) through (d) (except (d)(1)(iii)), and (f) through (m).

(f)(2)(ii)

If an employee has breathing difficulty during fit testing or respirator use, the employer must provide the employee with a medical examination in accordance with paragraph (j) (3)(i)(C) of this section to determine whether or not the employee can use a respirator while performing the required duty.

TABLE II.—RESPIRATORY PROTECTION FOR LEAD AEROSOLS

Airborne concentration of lead or condition of use	Required respirator
Not in excess of 0.5 mg/m ³ (10X PEL)	Half-mask, air-purifying respirator equipped with high efficiency filters. ^{1,2}
Not in excess of 2.5 mg/m ³ (50X PEL)	Full facepiece, air-purifying respirator with high efficiency filters. ²
Not in excess of 50 mg/m ³ (1000X PEL)	(1) Any powered, air-purifying respirator with high efficiency filters ² ; or (2) Half-mask supplied-air respirator operated in positive-pressure mode. ²
Not in excess of 100 mg/m ³ (2000X PEL)	Supplier-air respirators with full facepiece, hood, helmet, or suit, operated in positive pressure mode.
Greater than 100 mg/m ³ , unknown concentration or fire fighting.	Full facepiece, self-contained breathing apparatus operated in positive-pressure mode.

¹ Respirators specified for high concentrations can be used at lower concentrations of lead.

² Full facepiece is required if the lead aerosols cause eye or skin irritation at the use concentrations.

³ A high efficiency particulate filter means 99.97 percent efficient against 0.3 micron size particles.

(f)(3)

Respirator selection.

(f)(3)(i)

The employer must select the appropriate respirator or combination of respirators from Table II of this section.

(f)(3)(ii)

The employer must provide a powered air-purifying respirator instead of the respirator specified in Table II of this section when an employee chooses to use this type of

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respirator and such a respirator provides adequate protection to the employee.

..1910.1025(g)

(g)

Protective work clothing and equipment -

(g)(1)

Provision and use. If an employee is exposed to lead above the PEL, without regard to the use of respirators or where the possibility of skin or eye irritation exists, the employer shall provide at no cost to the employee and assure that the employee uses appropriate protective work clothing and equipment such as, but not limited to:

(g)(1)(i)

Coveralls or similar full-body work clothing;

(g)(1)(ii)

Gloves, hats, and shoes or disposable shoe coverlets; and

(g)(1)(iii)

Face shields, vented goggles, or other appropriate protective equipment which complies with 1910.133 of this Part.

(g)(2)

Cleaning and replacement.

(g)(2)(i)

The employer shall provide the protective clothing required in paragraph (g)(1) of this section in a clean and dry condition at least weekly, and daily to employees whose exposure levels without regard to a respirator are over 200 ug/m(3) of lead as an 8-hour TWA.

(g)(2)(ii)

The employer shall provide for the cleaning, laundering, or disposal of protective clothing and equipment required by paragraph (g)(1) of this section.

(g)(2)(iii)

The employer shall repair or replace required protective clothing and equipment as needed to maintain their effectiveness.

..1910.1025(g)(2)(iv)

(g)(2)(iv)

The employer shall assure that all protective clothing is removed at the completion of a work shift only in change rooms provided for that purpose as prescribed in paragraph (i) (2) of this section.

(g)(2)(v)

The employer shall assure that contaminated protective clothing which is to be cleaned, laundered, or disposed of, is placed in a closed container in the change-room which prevents dispersion of lead outside the container.

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The employer shall inform in writing any person who cleans or launders protective clothing or equipment of the potentially harmful effects of exposure to lead.

(g)(2)(vii)

The employer shall assure that the containers of contaminated protective clothing and equipment required by paragraph (g)(2)(v) are labeled as follows: CAUTION: CLOTHING CONTAMINATED WITH LEAD. DO NOT REMOVE DUST BY BLOWING OR SHAKING. DISPOSE OF LEAD CONTAMINATED WASH WATER IN ACCORDANCE WITH APPLICABLE LOCAL, STATE, OR FEDERAL REGULATIONS.

(g)(2)(viii)

The employer shall prohibit the removal of lead from protective clothing or equipment by blowing, shaking, or any other means which disperses lead into the air.

(h)

Housekeeping -

(h)(1)

Surfaces. All surfaces shall be maintained as free as practicable of accumulations of lead.

..1910.1025(h)(2)**(h)(2)**

Cleaning floors.

(h)(2)(i)

Floors and other surfaces where lead accumulates may not be cleaned by the use of compressed air.

(h)(2)(ii)

Shoveling, dry or wet sweeping, and brushing may be used only where vacuuming or other equally effective methods have been tried and found not to be effective.

(h)(3)

Vacuuming. Where vacuuming methods are selected, the vacuums shall be used and emptied in a manner which minimizes the reentry of lead into the workplace.

(i)

Hygiene facilities and practices.

(i)(1)

The employer shall assure that in areas where employees are exposed to lead above the PEL, without regard to the use of respirators, food or beverage is not present or consumed, tobacco products are not present or used, and cosmetics are not applied, except in change rooms, lunchrooms, and showers required under paragraphs (i)(2) - through (i)(4) of this section.

(i)(2)

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Change rooms.

(i)(2)(i)

The employer shall provide clean change rooms for employees who work in areas where their airborne exposure to lead is above the PEL, without regard to the use of respirators.

..1910.1025(i)(2)(ii)

(i)(2)(ii)

The employer shall assure that change rooms are equipped with separate storage facilities for protective work clothing and equipment and for street clothes which prevent cross-contamination.

(i)(3)

Showers.

(i)(3)(i)

The employer shall assure that employees who work in areas where their airborne exposure to lead is above the PEL, without regard to the use of respirators, shower at the end of the work shift.

(i)(3)(ii)

The employer shall provide shower facilities in accordance with 1910.141 (d)(3) of this part.

(i)(3)(iii)

The employer shall assure that employees who are required to shower pursuant to paragraph (i)(3)(i) do not leave the workplace wearing any clothing or equipment worn during the work shift.

(i)(4)

Lunchrooms.

(i)(4)(i)

The employer shall provide lunchroom facilities for employees who work in areas where their airborne exposure to lead is above the PEL, without regard to the use of respirators.

(i)(4)(ii)

The employer shall assure that lunchroom facilities have a temperature controlled, positive pressure, filtered air supply, and are readily accessible to employees.

..1910.1025(i)(4)(iii)

(i)(4)(iii)

The employer shall assure that employees who work in areas where their airborne exposure to lead is above the PEL without regard to the use of a respirator wash their hands and face prior to eating, drinking, smoking or applying cosmetics.

(i)(4)(iv)

The employer shall assure that employees do not enter lunchroom facilities with protective work clothing or equipment unless surface lead dust has been removed by

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vacuuming, down draft booth, or other cleaning method.

(i)(5)

Lavatories. The employer shall provide an adequate number of lavatory facilities which comply with 1910.141(d)(1) and (2) of this part.

(j)

Medical surveillance -

(j)(1)

General.

(j)(1)(i)

The employer shall institute a medical surveillance program for all employees who are or may be exposed above the action level for more than 30 days per year.

(j)(1)(ii)

The employer shall assure that all medical examinations and procedures are performed by or under the supervision of a licensed physician.

(j)(1)(iii)

The employer shall provide the required medical surveillance including multiple physician review under paragraph (j)(3)(iii) without cost to employees and at a reasonable time and place.

..1910.1025(j)(2)

(j)(2)

Biological monitoring -

(j)(2)(i)

Blood lead and ZPP level sampling and analysis. The employer shall make available biological monitoring in the form of blood sampling and analysis for lead and zinc protoporphyrin levels to each employee covered under paragraph (j)(1)(i) of this section on the following schedule:

(j)(2)(i)(A)

At least every 6 months to each employee covered under paragraph (j)(1)(i) of this section;

(j)(2)(i)(B)

At least every two months for each employee whose last blood sampling and analysis indicated a blood lead level at or above 40 ug/100 g of whole blood. This frequency shall continue until two consecutive blood samples and analyses indicate a blood lead level below 40 ug/100 g of whole blood; and

(j)(2)(i)(C)

At least monthly during the removal period of each employee removed from exposure to lead due to an elevated blood lead level.

(j)(2)(ii)

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Follow-up blood sampling tests. Whenever the results of a blood lead level test indicate that an employee's blood lead level exceeds the numerical criterion for medical removal under paragraph (k)(1)(i)(A), of this section, the employer shall provide a second (follow-up) blood sampling test within two weeks after the employer receives the results of the first blood sampling test.

..1910.1025(j)(2)(iii)

(j)(2)(iii)

Accuracy of blood lead level sampling and analysis. Blood lead level sampling and analysis provided pursuant to this section shall have an accuracy (to a confidence level of 95 percent) within plus or minus 15 percent or 6 ug/100 ml, whichever is greater, and shall be conducted by a laboratory licensed by the Center for Disease Control, United States Department of Health, Education and Welfare (CDC) or which has received a satisfactory grade in blood lead proficiency testing from CDC in the prior twelve months.

(j)(2)(iv)

Employee notification. Within five working days after the receipt of biological monitoring results, the employer shall notify in writing each employee whose blood lead level exceeds 40 ug/100 g:

(j)(2)(iv)(A)

of that employee's blood lead level and (B) that the standard requires temporary medical removal with Medical Removal Protection benefits when an employee's blood lead level exceeds the numerical criterion for medical removal under paragraph (k)(1)(i) of this section.

(j)(3)

Medical examinations and consultations -

(j)(3)(i)

Frequency. The employer shall make available medical examinations and consultations to each employee covered under paragraph (j)(1)(i) of this section on the following schedule:

(j)(3)(i)(A)

At least annually for each employee for whom a blood sampling test conducted at any time during the preceding 12 months indicated a blood lead level at or above 40 ug/100 g;

(j)(3)(i)(B)

Prior to assignment for each employee being assigned for the first time to an area in which airborne concentrations of lead are at or above the action level;

..1910.1025(j)(3)(i)(C)

(j)(3)(i)(C)

As soon as possible, upon notification by an employee either that the employee has developed signs or symptoms commonly associated with lead intoxication, that the employee desires medical advice concerning the effects of current or past exposure to lead on the employee's ability to procreate a healthy child, or that the employee has demonstrated difficulty in breathing during a respirator fitting test or during use; and

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As medically appropriate for each employee either removed from exposure to lead due to a risk of sustaining material impairment to health, or otherwise limited pursuant to a final medical determination.

(j)(3)(ii)

Content. Medical examinations made available pursuant to paragraph (j)(3)(i)(A)-(B) of this section shall include the following elements:

(j)(3)(ii)(A)

A detailed work history and a medical history, with particular attention to past lead exposure (occupational and non-occupational), personal habits (smoking, hygiene), and past gastrointestinal, hematologic, renal, cardiovascular, reproductive and neurological problems;

(j)(3)(ii)(B)

A thorough physical examination, with particular attention to teeth, gums, hematologic, gastrointestinal, renal, cardiovascular, and neurological systems. Pulmonary status should be evaluated if respiratory protection will be used;

(j)(3)(ii)(C)

A blood pressure measurement;

(j)(3)(ii)(D)

A blood sample and analysis which determines:

(j)(3)(ii)(D)(1)

Blood lead level;

..1910.1025(j)(3)(ii)(D)(2)

(j)(3)(ii)(D)(2)

Hemoglobin and hematocrit determinations, red cell indices, and examination of peripheral smear morphology;

(j)(3)(ii)(D)(3)

Zinc protoporphyrin;

(j)(3)(ii)(D)(4)

Blood urea nitrogen; and,

(j)(3)(ii)(D)(5)

Serum creatinine;

(j)(3)(ii)(E)

A routine urinalysis with microscopic examination; and

(j)(3)(ii)(F)

Any laboratory or other test which the examining physician deems necessary by sound medical practice. The content of medical examinations made available pursuant to paragraph (j)(3)(i)(C) - (D) of this section shall be determined by an examining physician

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and, if requested by an employee, shall include pregnancy testing or laboratory evaluation of male fertility.

(j)(3)(iii)

Multiple physician review mechanism.

(j)(3)(iii)(A)

If the employer selects the initial physician who conducts any medical examination or consultation provided to an employee under this section, the employee may designate a second physician:

(j)(3)(iii)(A)(1)

To review any findings, determinations or recommendations of the initial physician; and

..1910.1025(j)(3)(iii)(A)(2)

(j)(3)(iii)(A)(2)

To conduct such examinations, consultations, and laboratory tests as the second physician deems necessary to facilitate this review.

(j)(3)(iii)(B)

The employer shall promptly notify an employee of the right to seek a second medical opinion after each occasion that an initial physician conducts a medical examination or consultation pursuant to this section. The employer may condition its participation in, and payment for, the multiple physician review mechanism upon the employee doing the following within fifteen (15) days after receipt of the foregoing notification, or receipt of the initial physician's written opinion, whichever is later:

(j)(3)(iii)(B)(1)

The employee informing the employer that he or she intends to seek a second medical opinion, and

(j)(3)(iii)(B)(2)

The employee initiating steps to make an appointment with a second physician.

(j)(3)(iii)(C)

If the findings, determinations or recommendations of the second physician differ from those of the initial physician, then the employer and the employee shall assure that efforts are made for the two physicians to resolve any disagreement.

(j)(3)(iii)(D)

If the two physicians have been unable to quickly resolve their disagreement, then the employer and the employee through their respective physicians shall designate a third physician:

..1910.1025(j)(3)(iii)(D)(1)

(j)(3)(iii)(D)(1)

To review any findings, determinations or recommendations of the prior physicians; and

(j)(3)(iii)(D)(2)

To conduct such examinations, consultations, laboratory tests and discussions with the

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prior physicians as the third physician deems necessary to resolve the disagreement of the prior physicians.

(j)(3)(iii)(E)

The employer shall act consistent with the findings, determinations and recommendations of the third physician, unless the employer and the employee reach an agreement which is otherwise consistent with the recommendations of at least one of the three physicians.

(j)(3)(iv)

Information provided to examining and consulting physicians.

(j)(3)(iv)(A)

The employer shall provide an initial physician conducting a medical examination or consultation under this section with the following information:

(j)(3)(iv)(A)(1)

A copy of this regulation for lead including all Appendices;

(j)(3)(iv)(A)(2)

A description of the affected employee's duties as they relate to the employee's exposure;

(j)(3)(iv)(A)(3)

The employee's exposure level or anticipated exposure level to lead and to any other toxic substance (if applicable);

..1910.1025(j)(3)(iv)(A)(4)**(j)(3)(iv)(A)(4)**

A description of any personal protective equipment used or to be used;

(j)(3)(iv)(A)(5)

Prior blood lead determinations; and

(j)(3)(iv)(A)(6)

All prior written medical opinions concerning the employee in the employer's possession or control.

(j)(3)(iv)(B)

The employer shall provide the foregoing information to a second or third physician conducting a medical examination or consultation under this section upon request either by the second or third physician, or by the employee.

(j)(3)(v)

Written medical opinions.

(j)(3)(v)(A)

The employer shall obtain and furnish the employee with a copy of a written medical opinion from each examining or consulting physician which contains the following

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information:

(j)(3)(v)(A)(1)

The physician's opinion as to whether the employee has any detected medical condition which would place the employee at increased risk of material impairment of the employee's health from exposure to lead;

(j)(3)(v)(A)(2)

Any recommended special protective measures to be provided to the employee, or limitations to be placed upon the employee's exposure to lead;

..1910.1025(j)(3)(v)(A)(3)

(j)(3)(v)(A)(3)

Any recommended limitation upon the employee's use of respirators, including a determination of whether the employee can wear a powered air purifying respirator if a physician determines that the employee cannot wear a negative pressure respirator; and

(j)(3)(v)(A)(4)

The results of the blood lead determinations.

(j)(3)(v)(B)

The employer shall instruct each examining and consulting physician to:

(j)(3)(v)(B)(1)

Not reveal either in the written opinion, or in any other means of communication with the employer, findings, including laboratory results, or diagnoses unrelated to an employee's occupational exposure to lead; and

(j)(3)(v)(B)(2)

Advise the employee of any medical condition, occupational or nonoccupational, which dictates further medical examination or treatment.

(j)(3)(vi)

Alternate Physician Determination Mechanisms. The employer and an employee or authorized employee representative may agree upon the use of any expeditious alternate physician determination mechanism in lieu of the multiple physician review mechanism provided by this paragraph so long as the alternate mechanism otherwise satisfies the requirements contained in this paragraph.

(j)(4)

Chelation.

(j)(4)(i)

The employer shall assure that any person whom he retains, employs, supervises or controls does not engage in prophylactic chelation of any employee at any time.

..1910.1025(j)(4)(ii)

(j)(4)(ii)

If therapeutic or diagnostic chelation is to be performed by any person in paragraph (j)(4)(i), the employer shall assure that it be done under the supervision of a licensed

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physician in a clinical setting with thorough and appropriate medical monitoring and that the employee is notified in writing prior to its occurrence.

(k)

Medical Removal Protection -

(k)(1)

Temporary medical removal and return of an employee -

(k)(1)(i)

Temporary removal due to elevated blood lead levels -

(k)(1)(i)(A)

The employer shall remove an employee from work having an exposure to lead at or above the action level on each occasion that a periodic and a follow-up blood sampling test conducted pursuant to this section indicate that the employee's blood lead level is at or above 60 ug/100 g of whole blood; and,

(k)(1)(i)(B)

The employer shall remove an employee from work having an exposure to lead at or above the action level on each occasion that the average of the last three blood sampling tests conducted pursuant to this section (or the average of all blood sampling tests conducted over the previous six (6) months, whichever is longer) indicates that the employee's blood lead level is at or above 50 ug/100 g of whole blood; provided, however, that an employee need not be removed if the last blood sampling test indicates a blood lead level at or below 40 ug/100 g of whole blood.

..1910.1025(k)(1)(ii)

(k)(1)(ii)

Temporary removal due to a final medical determination.

(k)(1)(ii)(A)

The employer shall remove an employee from work having an exposure to lead at or above the action level on each occasion that a final medical determination results in a medical finding, determination, or opinion that the employee has a detected medical condition which places the employee at increased risk of material impairment to health from exposure to lead.

(k)(1)(ii)(B)

For the purposes of this section, the phrase "final medical determination" shall mean the outcome of the multiple physician review mechanism or alternate medical determination mechanism used pursuant to the medical surveillance provisions of this section.

(k)(1)(ii)(C)

Where a final medical determination results in any recommended special protective measures for an employee, or limitations on an employee's exposure to lead, the employer shall implement and act consistent with the recommendation.

(k)(1)(iii)

Return of the employee to former job status.

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(k)(1)(iii)(A)

The employer shall return an employee to his or her former job status:

(k)(1)(iii)(A)(1)

For an employee removed due to a blood lead level at or above 60 ug/100 g, or due to an average blood lead level at or above 50 ug/100 g, when two consecutive blood sampling tests indicate that the employee's blood lead level is at or below 40 ug/100 g of whole blood;

..1910.1025(k)(1)(iii)(A)(2)**(k)(1)(iii)(A)(2)**

For an employee removed due to a final medical determination, when a subsequent final medical determination results in a medical finding, determination, or opinion that the employee no longer has a detected medical condition which places the employee at increased risk of material impairment to health from exposure to lead.

(k)(1)(iii)(B)

For the purposes of this section, the requirement that an employer return an employee to his or her former job status is not intended to expand upon or restrict any rights an employee has or would have had, absent temporary medical removal, to a specific job classification or position under the terms of a collective bargaining agreement.

(k)(1)(iv)

Removal of other employee special protective measure or limitations. The employer shall remove any limitations placed on an employee or end any special protective measures provided to an employee pursuant to a final medical determination when a subsequent final medical determination indicates that the limitations or special protective measures are no longer necessary.

(k)(1)(v)

Employer options pending a final medical determination. Where the multiple physician review mechanism, or alternate medical determination mechanism used pursuant to the medical surveillance provisions of this section, has not yet resulted in a final medical determination with respect to an employee, the employer shall act as follows:

..1910.1025(k)(1)(v)(A)**(k)(1)(v)(A)**

Removal. The employer may remove the employee from exposure to lead, provide special protective measures to the employee, or place limitations upon the employee, consistent with the medical findings, determinations, or recommendations of any of the physicians who have reviewed the employee's health status.

(k)(1)(v)(B)

Return. The employer may return the employee to his or her former job status, end any special protective measures provided to the employee, and remove any limitations placed upon the employee, consistent with the medical findings, determinations, or recommendations of any of the physicians who have reviewed the employee's health status, with two exceptions. If -

(k)(1)(v)(B)(1)

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medical determination which differed from the findings, determinations, or recommendations of the initial physician or

(k)(1)(v)(B)(2)

The employee has been on removal status for the preceding eighteen months due to an elevated blood lead level, then the employer shall await a final medical determination.

(k)(2)

Medical removal protection benefits -

(k)(2)(i)

Provision of medical removal protection benefits. The employer shall provide to an employee up to eighteen (18) months of medical removal protection benefits on each occasion that an employee is removed from exposure to lead or otherwise limited pursuant to this section.

..1910.1025(k)(2)(ii)

(k)(2)(ii)

Definition of medical removal protection benefits. For the purposes of this section, the requirement that an employer provide medical removal protection benefits means that the employer shall maintain the earnings, seniority and other employment rights and benefits of an employee as though the employee had not been removed from normal exposure to lead or otherwise limited.

(k)(2)(iii)

Follow-up medical surveillance during the period of employee removal or limitation. During the period of time that an employee is removed from normal exposure to lead or otherwise limited, the employer may condition the provision of medical removal protection benefits upon the employee's participation in follow-up medical surveillance made available pursuant to this section.

(k)(2)(iv)

Workers' compensation claims. If a removed employee files a claim for workers' compensation payments for a lead-related disability, then the employer shall continue to provide medical removal protection benefits pending disposition of the claim. To the extent that an award is made to the employee for earnings lost during the period of removal, the employer's medical removal protection obligation shall be reduced by such amount. The employer shall receive no credit for workers' compensation payments received by the employee for treatment related expenses.

(k)(2)(v)

Other credits. The employer's obligation to provide medical removal protection benefits to a removed employee shall be reduced to the extent that the employee receives compensation for earnings lost during the period of removal either from a publicly or employer-funded compensation program, or receives income from employment with another employer made possible by virtue of the employee's removal.

..1910.1025(k)(2)(vi)

(k)(2)(vi)

Employees whose blood lead levels do not adequately decline within 18 months of removal. The employer shall take the following measures with respect to any employee removed from exposure to lead due to an elevated blood lead level whose blood lead

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level has not declined within the past eighteen (18) months of removal so that the employee has been returned to his or her former job status:

(k)(2)(vi)(A)

The employer shall make available to the employee a medical examination pursuant to this section to obtain a final medical determination with respect to the employee;

(k)(2)(vi)(B)

The employer shall assure that the final medical determination obtained indicates whether or not the employee may be returned to his or her former job status, and if not, what steps should be taken to protect the employee's health;

(k)(2)(vi)(C)

Where the final medical determination has not yet been obtained, or once obtained indicates that the employee may not yet be returned to his or her former job status, the employer shall continue to provide medical removal protection benefits to the employee until either the employee is returned to former job status, or a final medical determination is made that the employee is incapable of ever safely returning to his or her former job status.

..1910.1025(k)(2)(vi)(D)

(k)(2)(vi)(D)

Where the employer acts pursuant to a final medical determination which permits the return of the employee to his or her former job status despite what would otherwise be an unacceptable blood lead level, later questions concerning removing the employee again shall be decided by a final medical determination. The employer need not automatically remove such an employee pursuant to the blood lead level removal criteria provided by this section.

(k)(2)(vii)

Voluntary Removal or Restriction of An Employee. Where an employer, although not required by this section to do so, removes an employee from exposure to lead or otherwise places limitations on an employee due to the effects of lead exposure on the employee's medical condition, the employer shall provide medical removal protection benefits to the employee equal to that required by paragraph (k)(2)(i) of this section.

(I)

Employee information and training -

(I)(1)

Training program.

(I)(1)(i)

Each employer who has a workplace in which there is a potential exposure to airborne lead at any level shall inform employees of the content of Appendices A and B of this regulation.

(I)(1)(ii)

The employer shall institute a training program for and assure the participation of all employees who are subject to exposure to lead at or above the action level or for whom the possibility of skin or eye irritation exists.

ORIGINAL**(I)(1)(iii)**

The employer shall provide initial training by 180 days from the effective date for those employees covered by paragraph (I)(1)(ii) on the standard's effective date and prior to the time of initial job assignment for those employees subsequently covered by this paragraph.

(I)(1)(iv)

The training program shall be repeated at least annually for each employee.

(I)(1)(v)

The employer shall assure that each employee is informed of the following:

(I)(1)(v)(A)

The content of this standard and its appendices;

(I)(1)(v)(B)

The specific nature of the operations which could result in exposure to lead above the action level;

(I)(1)(v)(C)

The purpose, proper selection, fitting, use, and limitations of respirators;

(I)(1)(v)(D)

The purpose and a description of the medical surveillance program, and the medical removal protection program including information concerning the adverse health effects associated with excessive exposure to lead (with particular attention to the adverse reproductive effects on both males and females);

(I)(1)(v)(E)

The engineering controls and work practices associated with the employee's job assignment;

..1910.1025(I)(1)(v)(F)**(I)(1)(v)(F)**

The contents of any compliance plan in effect; and

(I)(1)(v)(G)

Instructions to employees that chelating agents should not routinely be used to remove lead from their bodies and should not be used at all except under the direction of a licensed physician;

(I)(2)

Access to information and training materials.

(I)(2)(i)

The employer shall make readily available to all affected employees a copy of this standard and its appendices.

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(I)(2)(ii)

The employer shall provide, upon request, all materials relating to the employee information and training program to the Assistant Secretary and the Director.

(I)(2)(iii)

In addition to the information required by paragraph (I)(1)(v), the employer shall include as part of the training program, and shall distribute to employees, any materials pertaining to the Occupational Safety and Health Act, the regulations issued pursuant to that Act, and this lead standard, which are made available to the employer by the Assistant Secretary.

..1910.1025(m)**(m)**

Signs -

(m)(1)

General.

(m)(1)(i)

The employer may use signs required by other statutes, regulations or ordinances in addition to, or in combination with, signs required by this paragraph.

(m)(1)(ii)

The employer shall assure that no statement appears on or near any sign required by this paragraph which contradicts or detracts from the meaning of the required sign.

(m)(2)

Signs.

(m)(2)(i)

The employer shall post the following warning signs in each work area where the PEL is exceeded:

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

(m)(2)(ii)

The employer shall assure that signs required by this paragraph are illuminated and cleaned as necessary so that the legend is readily visible.

(n)

Recordkeeping -

(n)(1)

Exposure monitoring.

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(n)(1)(i)

The employer shall establish and maintain an accurate record of all monitoring required in paragraph (d) of this section.

(n)(1)(ii)

This record shall include:

(n)(1)(ii)(A)

The date(s), number, duration, location and results of each of the samples taken, including a description of the sampling procedure used to determine representative employee exposure where applicable;

..1910.1025(n)(1)(ii)(B)

(n)(1)(ii)(B)

A description of the sampling and analytical methods used and evidence of their accuracy;

(n)(1)(ii)(C)

The type of respiratory protective devices worn, if any;

(n)(1)(ii)(D)

Name, social security number, and job classification of the employee monitored and of all other employees whose exposure the measurement is intended to represent; and

(n)(1)(ii)(E)

The environmental variables that could affect the measurement of employee exposure.

(n)(1)(iii)

The employer shall maintain these monitoring records for at least 40 years or for the duration of employment plus 20 years, whichever is longer.

(n)(2)

Medical surveillance.

(n)(2)(i)

The employer shall establish and maintain an accurate record for each employee subject to medical surveillance as required by paragraph (j) of this section.

(n)(2)(ii)

This record shall include:

(n)(2)(ii)(A)

The name, social security number, and description of the duties of the employee;

..1910.1025(n)(2)(ii)(B)

(n)(2)(ii)(B)

A copy of the physician's written opinions;

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(n)(2)(ii)(C)

Results of any airborne exposure monitoring done for that employee and the representative exposure levels supplied to the physician; and

(n)(2)(ii)(D)

Any employee medical complaints related to exposure to lead.

(n)(2)(iii)

The employer shall keep, or assure that the examining physician keeps, the following medical records:

(n)(2)(iii)(A)

A copy of the medical examination results including medical and work history required under paragraph (j) of this section;

(n)(2)(iii)(B)

A description of the laboratory procedures and a copy of any standards or guidelines used to interpret the test results or references to that information;

(n)(2)(iii)(C)

A copy of the results of biological monitoring.

(n)(2)(iv)

The employer shall maintain or assure that the physician maintains those medical records for at least 40 years, or for the duration of employment plus 20 years, whichever is longer.

..1910.1025(n)(3)**(n)(3)**

Medical removals.

(n)(3)(i)

The employer shall establish and maintain an accurate record for each employee removed from current exposure to lead pursuant to paragraph (k) of this section.

(n)(3)(ii)

Each record shall include:

(n)(3)(ii)(A)

The name and social security number of the employee;

(n)(3)(ii)(B)

The date on each occasion that the employee was removed from current exposure to lead as well as the corresponding date on which the employee was returned to his or her former job status;

(n)(3)(ii)(C)

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A brief explanation of how each removal was or is being accomplished; and

(n)(3)(ii)(D)

A statement with respect to each removal indicating whether or not the reason for the removal was an elevated blood lead level.

(n)(3)(iii)

The employer shall maintain each medical removal record for at least the duration of an employee's employment.

(n)(4)

Availability.

(n)(4)(i)

The employer shall make available upon request all records required to be maintained by paragraph (n) of this section to the Assistant Secretary and the Director for examination and copying.

..1910.1025(n)(4)(ii)

(n)(4)(ii)

Environmental monitoring, medical removal, and medical records required by this paragraph shall be provided upon request to employees, designated representatives, and the Assistant Secretary in accordance with 29 CFR 1910.1020 (a)-(e) and (2)-(i). Medical removal records shall be provided in the same manner as environmental monitoring records.

(n)(5)

Transfer of records.

(n)(5)(i)

Whenever the employer ceases to do business, the successor employer shall receive and retain all records required to be maintained by paragraph (n) of this section.

(n)(5)(ii)

Whenever the employer ceases to do business and there is no successor employer to receive and retain the records required to be maintained by this section for the prescribed period, these records shall be transmitted to the Director.

(n)(5)(iii)

At the expiration of the retention period for the records required to be maintained by this section, the employer shall notify the Director at least 3 months prior to the disposal of such records and shall transmit those records to the Director if requested within the period.

(n)(5)(iv)

The employer shall also comply with any additional requirements involving transfer of records set forth in 29 CFR 1910.1020(h).

(o)

Observation of monitoring.

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(o)(1)

Employee observation. The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to lead conducted pursuant to paragraph (d) of this section.

..1910.1025(o)(2)**(o)(2)**

Observation procedures.

(o)(2)(i)

Whenever observation of the monitoring of employee exposure to lead requires entry into an area where the use of respirators, protective clothing or equipment is required, the employer shall provide the observer with and assure the use of such respirators, clothing and such equipment, and shall require the observer to comply with all other applicable safety and health procedures.

(o)(2)(ii)

Without interfering with the monitoring, observers shall be entitled to:

(o)(2)(ii)(A)

Receive an explanation of the measurement procedures;

(o)(2)(ii)(B)

Observe all steps related to the monitoring of lead performed at the place of exposure; and

(o)(2)(ii)(C)

Record the results obtained or receive copies of the results when returned by the laboratory.

(p)

Effective date. This standard shall become effective March 1, 1979.

(q)

Appendices. The information contained in the appendices to this section is not intended by itself, to create any additional obligations not otherwise imposed by this standard nor detract from any existing obligation.

(r)

Startup dates. All obligations of this standard commence on the effective date except as follows:

(r)(1)

The initial determination under paragraph (d)(2) shall be made as soon as possible but no later than 30 days from the effective date.

..1910.1025(r)(2)**(r)(2)**

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Initial monitoring under paragraph (d)(4) shall be completed as soon as possible but no later than 90 days from the effective date.

(r)(3)

Initial biological monitoring and medical examinations under paragraph (j) shall be completed as soon as possible but no later than 180 days from the effective date. Priority for biological monitoring and medical examinations shall be given to employees whom the employer believes to be at greatest risk from continued exposure.

(r)(4)

Initial training and education shall be completed as soon as possible but no later than 180 days from the effective date.

(r)(5)

Hygiene and lunchroom facilities under paragraph (i) shall be in operation as soon as possible but no later than 1 year from the effective year.

(r)(6)**(r)(6)(i)**

Respiratory protection required by paragraph (f) shall be provided as soon as possible but no later than the following schedule:

(r)(6)(i)(A)

Employees whose 8-hour TWA exposure exceeds 200 ug/m(3)-on the effective date.

(r)(6)(i)(B)

Employees whose 8-hour TWA exposure exceeds the PEL but is less than 200 ug/m(3)-150 days from the effective date.

..1910.1025(r)(6)(i)(C)**(r)(6)(i)(C)**

Powered, air-purifying respirators provided under (f)(2)(ii)-210 days from the effective date.

(r)(6)(i)(D)

Quantitative fit testing required under (f)(3)(ii)-one year from effective date. Qualitative fit testing is required in the interim.

(r)(7)**(r)(7)(i)**

Written compliance plans required by paragraph (e)(3) shall be completed and available for inspection and copying as soon as possible but no later than the following schedule:

(r)(7)(i)(A)

Employers for whom compliance with the PEL or interim level is required within 1 year

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from the effective date-6 months from the effective date.

(r)(7)(i)(B)

Employers in secondary smelting and refining, lead storage battery manufacturing lead pigment manufacturing and nonferrous foundry industries-1 year from the effective date.

(r)(7)(i)(C)

Employers in primary smelting and refining industry-1 year from the effective date for the interim level; 5 years from the effective date for PEL.

(r)(7)(i)(D)

Plans for construction of hygiene facilities, if required-6 months from the effective date.

..1910.1025(r)(8)

(r)(8)

The permissible exposure limit in paragraph (c) shall become effective 150 days from the effective date.

[60 FR 52856, Oct. 11, 1995; 61 FR 5507, Feb. 13, 1996; 63 FR 1152, Jan. 8, 1998; 63 FR 20098, April 23, 1998]

◀ OSHA Regulations (Standards - 29 CFR) - Table of Contents

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OSHA Regulations (Standards - 29 CFR)

Substance data sheet for occupational exposure to lead - 1910.1025 App A

◀ OSHA Regulations (Standards - 29 CFR) - Table of Contents

- **Standard Number:** 1910.1025 App A
- **Standard Title:** Substance data sheet for occupational exposure to lead
- **SubPart Number:** Z
- **SubPart Title:** Toxic and Hazardous Substances
- **Applicable Standard:** Applicable Standard:

I. SUBSTANCE IDENTIFICATION

A. Substance: Pure lead (Pb) is a heavy metal at room temperature and pressure and is a basic chemical element. It can combine with various other substances to form numerous lead compounds.

B. Compounds Covered by the Standard: The word "lead" when used in this standard means elemental lead, all inorganic lead compounds and a class of organic lead compounds called lead soaps. This standard does not apply to other organic lead compounds.

C. Uses: Exposure to lead occurs in at least 120 different occupations, including primary and secondary lead smelting, lead storage battery manufacturing, lead pigment manufacturing and use, solder manufacturing and use, shipbuilding and ship repairing, auto manufacturing, and printing.

D. Permissible Exposure: The Permissible Exposure Limit (PEL) set by the standard is 50 micrograms of lead per cubic meter of air (50 ug/m(3)), averaged over an 8-hour workday.

E. Action Level: The standard establishes an action level of 30 micrograms per cubic meter of air (30 ug/m(3)), time weighted average, based on an 8-hour work-day. The action level initiates several requirements of the standard, such as exposure monitoring, medical surveillance, and training and education.

II. HEALTH HAZARD DATA

A. Ways in which lead enters your body. When absorbed into your body in certain doses lead is a toxic substance. The object of the lead standard is to prevent absorption of harmful quantities of lead. The standard is intended to protect you not only from the immediate toxic effects of lead, but also from the serious toxic effects that may not become apparent until years of exposure have passed.

Lead can be absorbed into your body by inhalation (breathing) and ingestion (eating). Lead (except for certain organic lead compounds not covered by the standard, such as tetraethyl lead) is not absorbed through your skin. When lead is scattered in the air as a dust, fume or mist it can be inhaled and absorbed through your lungs and upper respiratory tract. Inhalation of airborne lead is generally the most important source of occupational lead absorption. You can also absorb lead through your digestive system if

A diagonal stamp with the word "ORIGINAL" in a bold, sans-serif font.

lead gets into your mouth and is swallowed. If you handle food, cigarettes, chewing tobacco, or make-up which have lead on them or handle them with hands contaminated with lead, this will contribute to ingestion.

A significant portion of the lead that you inhale or ingest gets into your blood stream. Once in your blood stream, lead is circulated throughout your body and stored in various organs and body tissues. Some of this lead is quickly filtered out of your body and excreted, but some remains in the blood and other tissues. As exposure to lead continues, the amount stored in your body will increase if you are absorbing more lead than your body is excreting. Even though you may not be aware of any immediate symptoms of disease, this lead stored in your tissues can be slowly causing irreversible damage, first to individual cells, then to your organs and whole body systems.

B. Effects of overexposure to lead - (1) Short term (acute) overexposure. Lead is a potent, systemic poison that serves no known useful function once absorbed by your body. Taken in large enough doses, lead can kill you in a matter of days. A condition affecting the brain called acute encephalopathy may arise which develops quickly to seizures, coma, and death from cardiorespiratory arrest. A short term dose of lead can lead to acute encephalopathy. Short term occupational exposures of this magnitude are highly unusual, but not impossible. Similar forms of encephalopathy may, however, arise from extended, chronic exposure to lower doses of lead. There is no sharp dividing line between rapidly developing acute effects of lead, and chronic effects which take longer to acquire. Lead adversely affects numerous body systems, and causes forms of health impairment and disease which arise after periods of exposure as short as days or as long as several years.

(2) Long-term (chronic) overexposure. Chronic overexposure to lead may result in severe damage to your blood-forming, nervous, urinary and reproductive systems. Some common symptoms of chronic overexposure include loss of appetite, metallic taste in the mouth, anxiety, constipation, nausea, pallor, excessive tiredness, weakness, insomnia, headache, nervous irritability, muscle and joint pain or soreness, fine tremors, numbness, dizziness, hyperactivity and colic. In lead colic there may be severe abdominal pain.

Damage to the central nervous system in general and the brain (encephalopathy) in particular is one of the most severe forms of lead poisoning. The most severe, often fatal, form of encephalopathy may be preceded by vomiting, a feeling of dullness progressing to drowsiness and stupor, poor memory, restlessness, irritability, tremor, and convulsions. It may arise suddenly with the onset of seizures, followed by coma, and death. There is a tendency for muscular weakness to develop at the same time. This weakness may progress to paralysis often observed as a characteristic "wrist drop" or "foot drop" and is a manifestation of a disease to the nervous system called peripheral neuropathy.

Chronic overexposure to lead also results in kidney disease with few, if any, symptoms appearing until extensive and most likely permanent kidney damage has occurred. Routine laboratory tests reveal the presence of this kidney disease only after about two-thirds of kidney function is lost. When overt symptoms of urinary dysfunction arise, it is often too late to correct or prevent worsening conditions, and progression to kidney dialysis or death is possible.

Chronic overexposure to lead impairs the reproductive systems of both men and women. Overexposure to lead may result in decreased sex drive, impotence and sterility in men. Lead can alter the structure of sperm cells raising the risk of birth defects. There is evidence of miscarriage and stillbirth in women whose husbands were exposed to lead or who were exposed to lead themselves. Lead exposure also may result in decreased fertility, and abnormal menstrual cycles in women. The course of pregnancy may be adversely affected by exposure to lead since lead crosses the placental barrier and poses risks to developing fetuses. Children born of parents either one of whom were exposed to excess lead levels are more likely to have birth defects, mental retardation, behavioral

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disorders or die during the first year of childhood.

Overexposure to lead also disrupts the blood-forming system resulting in decreased hemoglobin (the substance in the blood that carries oxygen to the cells) and ultimately anemia. Anemia is characterized by weakness, pallor and fatigability as a result of decreased oxygen carrying capacity in the blood.

(3) Health protection goals of the standard. Prevention of adverse health effects for most workers from exposure to lead throughout a working lifetime requires that worker blood lead (PbB) levels be maintained at or below forty micrograms per one hundred grams of whole blood (40 ug/100g). The blood lead levels of workers (both male and female workers) who intend to have children should be maintained below 30 ug/100g to minimize adverse reproductive health effects to the parents and to the developing fetus.

The measurement of your blood lead level is the most useful indicator of the amount of lead being absorbed by your body. Blood lead levels (PbB) are most often reported in units of milligrams (mg) or micrograms (ug) of lead (1 mg=1000 ug) per 100 grams (100g), 100 milliliters (100 ml) or deciliter (dl) of blood. These three units are essentially the same. Sometime PbB's are expressed in the form of mg% or ug%. This is a shorthand notation for 100g, 100 ml, or dl.

PbB measurements show the amount of lead circulating in your blood stream, but do not give any information about the amount of lead stored in your various tissues. PbB measurements merely show current absorption of lead, not the effect that lead is having on your body or the effects that past lead exposure may have already caused. Past research into lead-related diseases, however, has focused heavily on associations between PbBs and various diseases. As a result, your PbB is an important indicator of the likelihood that you will gradually acquire a lead-related health impairment or disease.

Once your blood lead level climbs above 40 ug/100g, your risk of disease increases. There is a wide variability of individual response to lead, thus it is difficult to say that a particular PbB in a given person will cause a particular effect. Studies have associated fatal encephalopathy with PbBs as low as 150 ug/100g. Other studies have shown other forms of diseases in some workers with PbBs well below 80 ug/100g. Your PbB is a crucial indicator of the risks to your health, but one other factor is also extremely important. This factor is the length of time you have had elevated PbBs. The longer you have an elevated PbB, the greater the risk that large quantities of lead are being gradually stored in your organs and tissues (body burden). The greater your overall body burden, the greater the chances of substantial permanent damage.

The best way to prevent all forms of lead-related impairments and diseases-both short term and long term- is to maintain your PbB below 40 ug/100g. The provisions of the standard are designed with this end in mind. Your employer has prime responsibility to assure that the provisions of the standard are complied with both by the company and by individual workers. You as a worker, however, also have a responsibility to assist your employer in complying with the standard. You can play a key role in protecting your own health by learning about the lead hazards and their control, learning what the standard requires, following the standard where it governs your own actions, and seeing that your employer complies with provisions governing his actions.

(4) Reporting signs and symptoms of health problems. You should immediately notify your employer if you develop signs or symptoms associated with lead poisoning or if you desire medical advice concerning the effects of current or past exposure to lead on your ability to have a healthy child. You should also notify your employer if you have difficulty breathing during a respirator fit test or while wearing a respirator. In each of these cases your employer must make available to you appropriate medical examinations or consultations. These must be provided at no cost to you and at a reasonable time and place.

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The standard contains a procedure whereby you can obtain a second opinion by a physician of your choice if the employer selected the initial physician.

[56 FR 24686, May 31, 1991]

◀ [OSHA Regulations \(Standards - 29 CFR\) - Table of Contents](#)

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Appendix F

Additional Task Hazard Analyses

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Appendix G

Air Sampling Methods

ELEMENTS by ICP

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MW: Table 1

CAS: Table 2

RTECS: Table 2

METHOD: 7300, Issue 2

EVALUATION: PARTIAL

Issue 1: 15 August 1990

Issue 2: 15 August 1994

OSHA: Table 2

NIOSH: Table 2

ACGIH: Table 2

PROPERTIES: Table 1

ELEMENTS: aluminum*	chromium*	lithium*	phosphorus	tellurium	zinc
arsenic	cobalt*	magnesium	platinum*	thallium	zirconium*
beryllium*	copper	manganese*	selenium	titanium	
Cadmium	iron	molybdenum*	silver	vanadium	
calcium	lead* nickel	sodium	yttrium		

*Some compounds of these elements require special sample treatment.

SAMPLING		MEASUREMENT	
SAMPLER:	FILTER (0.8- μ m, cellulose ester membrane)	TECHNIQUE:	INDUCTIVELY COUPLED ARGON PLASMA, ATOMIC EMISSION SPECTROSCOPY
FLOWRATE:	1 to 4 L/min	ANALYTE:	elements above
VOL-MIN:	Table 1	ASHING	
-MAX:	Table 1	REAGENTS:	conc. HNO ₃ , 4 mL; and conc. HClO ₄ , 1 mL
SHIPMENT:	routine	CONDITIONS:	room temperature, 30 min; 150 °C to near dryness
SAMPLE		FINAL	
STABILITY:	stable	SOLUTION:	4% HNO ₃ , 1% HClO ₄ , 10 mL
BLANKS:	2 to 10 field blanks per set	WAVELENGTH:	depends upon element; Table 3
ACCURACY		BACKGROUND	
RANGE STUDIED:	not studied	CORRECTION:	spectral wavelength shift
BIAS:	none identified	CALIBRATION:	elements in 4% HNO ₃ , 1% HClO ₄
OVERALL PRECISION (\hat{s}):	not evaluated	RANGE:	2.5 to 1000 μ g per sample [1]
ACCURACY:	not determined	ESTIMATED LOD:	1 μ g per sample [1]
		PRECISION (\hat{s}):	Table 3

APPLICABILITY: The working range of this method is 0.005 to 2.0 mg/m³ for each element in a 500-L air sample. This is simultaneous elemental analysis, not compound specific. An alternative microwave digestion procedure is included. Verify that the types of compounds in the samples are soluble with the ashing procedure selected.

INTERFERENCES: Spectral interferences are the primary interferences encountered in ICP-AES analysis. These are minimized by judicious wavelength selection, interelement correction factors and background correction [1,2].

OTHER METHODS: This method replaces P&CAM 351 [2] for trace elements. Flame atomic absorption spectroscopy (e.g., Methods 70XX) is an alternate analytical technique for many of these elements. Graphite furnace AAS (e.g., 7102 for Be, 7105 for Pb) is more sensitive.

REAGENTS:

1. Nitric acid, conc., ultra pure.
2. Perchloric acid, conc., ultra pure.*
3. Ashing acid: 4:1 (v/v) HNO₃:HClO₄. Mix 4 volumes conc. HNO₃ with 1 volume conc. HClO₄.
4. Calibration stock solutions, 1000 µg/mL. Commercially available, or prepared per instrument manufacturer's recommendation (see step 12).
5. Dilution acid, 4% HNO₃, 1% HClO₄. Add 50 mL ashing acid to 600 mL water; dilute to 1 L.
6. Argon.
7. Distilled, deionized water.

* See SPECIAL PRECAUTIONS.

EQUIPMENT:

1. Sampler: cellulose ester membrane filter, 0.8-µm pore size, 37-mm diameter; in cassette filter holder.
2. Personal sampling pump, 1 to 4 L/min, with flexible connecting tubing.
3. Inductively coupled plasma-atomic emission spectrometer, equipped as specified by the manufacturer for analysis of elements of interest.
4. Regulator, two-stage, for argon.
5. Beakers, Phillips, 125-mL, or Griffin, 50-mL, with watchglass covers.**
6. Volumetric flasks, 10- and 100- mL.**
7. Assorted volumetric pipets as needed.**
8. Hotplate, surface temperature 150°C.

** Clean all glassware with conc. nitric acid and rinse thoroughly in distilled water before use.

SPECIAL PRECAUTIONS: Perform all perchloric acid digestions in a perchloric acid hood.

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Sample at an accurately known flow rate between 1 and 4 L/min for a total sample size of 200 to 2000 L (see Table 1) for TWA measurements. Do not exceed a filter loading of approximately 2 mg total dust.

SAMPLE PREPARATION:

3. Open the cassette filter holders and transfer the samples and blanks to clean beakers.
4. Add 5 mL ashing acid. Cover with a watchglass. Let stand 30 min at room temperature.
NOTE: Start a reagent blank at this step.
5. Heat on hotplate (120°C) until ca. 0.5 mL remains.
NOTE 1: Recovery of lead from some paint matrices may require other digestion techniques. See Method 7082 (Lead by Flame AAS) for an alternative hotplate digestion procedure or the Appendix for a microwave digestion procedure [8].
NOTE 2: Some species of Al, Be, Co, Cr, Li, Mn, Mo, V, and Zr will not be completely solubilized by this procedure. Alternative solubilization techniques for most of these elements can be found elsewhere [2-7]. For example, aqua regia may be needed for Mn [4,9].
6. Add 2 mL ashing acid and repeat step 5. Repeat this step until the solution is clear.
7. Remove watchglass and rinse into the beaker with distilled water.
8. Increase the temperature to 150°C and take the sample to near dryness (ca. 0.5 mL).
9. Dissolve the residue in 2 to 3 mL dilution acid.
10. Transfer the solutions quantitatively to 10-mL volumetric flasks.
11. Dilute to volume with dilution acid.

CALIBRATION AND QUALITY CONTROL:

12. Calibrate the spectrometer according to the manufacturers recommendations.
NOTE: Typically, an acid blank and 10 µg/mL multielement working standards are used. The following multielement combinations are chemically compatible in 4% HNO₃/1%

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HClO₄:

- a. Ag, Ca, Co, Mn, Pb, V, Zn;
 - b. Al, Be, Cd, La, Li, Ni, Ti;
 - c. As, B, Ba, Mg, Mo, P;
 - d. Cu, Fe, Na, Pt, Sr, Te, Y;
 - e. Cr, K, Se, Ti, Zr; and
 - f. Si, W (distilled water only)
13. Analyze a standard for every ten samples.
 14. Check recoveries with at least two spiked media blanks per ten samples.

MEASUREMENT:

15. Set spectrometer to conditions specified by manufacturer.
16. Analyze standards and samples.

NOTE: If the values for the samples are above the range of the standards, dilute the solutions with dilution acid, reanalyze and apply the appropriate dilution factor in the calculations.

CALCULATIONS:

17. Obtain the solution concentrations for the sample, C_s (g/mL), and the average media blank, C_b (µg/mL), from the instrument.
18. Using the solution volumes of sample, V_s (mL), and media blank, V_b (mL), calculate the concentration, C (mg/m³), of each element in the air volume sampled, V (L):

$$C = \frac{C_s V_s - C_b V_b}{V}, \text{ mg/m}^3.$$

EVALUATION OF METHOD:

Method P&CAM 351 was evaluated in 1981 [1,2]. The precision and recovery data were determined at 2.5 and 1000 µg of each element per sample on spiked filters. The precision and recovery data, instrumental detection limits, sensitivity, and analytical wavelengths are listed in Table 3. The values in Table 3 were determined with a Jarrell-Ash Model 1160 ICP operated according to manufacturer's instructions.

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METHOD WRITTEN BY:

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James B. Perkins, David L. Wheeler, and Keith Nicholson, DataChem Laboratories, Salt Lake City, UT, prepared the microwave digestion procedure in the Appendix.

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TABLE 1. PROPERTIES AND SAMPLING VOLUMES

Element (Symbol)	Properties		Air Volume, L @ OSHA PEL	
	Atomic Weight	MP, °C	MIN	MAX
Silver (Ag)	107.87	961	250	2000
Aluminum (Al)	26.98	660	5	100
Arsenic (As)	74.92	817	5	2000
Beryllium (Be)	9.01	1278	1250	2000
Calcium (Ca)	40.08	842	5	200
Cadmium (Cd)	112.40	321	13	2000
Cobalt (Co)	58.93	1495	25	2000
Chromium (Cr)	52.00	1890	5	1000
Copper (Cu)	63.54	1083	5	1000
Iron (Fe)	55.85	1535	5	100
Lithium (Li)	6.94	179	100	2000
Magnesium (Mg)	24.31	651	5	67
Manganese (Mn)	54.94	1244	5	200
Molybdenum (Mo)	95.94	651	5	67
Sodium (Na)	22.99	98	13	2000
Nickel (Ni)	58.71	1453	5	1000
Phosphorus (P)	30.97	44	25	2000
Lead (Pb)	207.19	328	50	2000
Platinum (Pt)	195.09	1769	1250	2000
Selenium (Se)	78.96	217	13	2000
Tellurium (Te)	127.60	450	25	2000
Titanium (Ti)	47.90	1675	5	100
Thallium (Tl)	204.37	304	25	2000
Vanadium (V)	50.94	1890	5	2000
Yttrium (Y)	88.91	1495	5	1000
Zinc (Zn)	65.37	419	5	200
Zirconium (Zr)	91.22	1852	5	200

TABLE 2. EXPOSURE LIMITS, CAS #, RTECS

Element (Symbol)	CAS #	RTECS	Exposure Limits, mg/m ³ (Ca = carcinogen)		
			OSHA	NIOSH	ACGIH
Silver (Ag)	7440-22-4	VW3500000	0.01 (dust, fume, metal)	0.01 (metal, soluble)	0.1 (metal) 0.01 (soluble)
Aluminum (Al)	7429-90-5	BD0330000	15 (total) 5 (respirable)	5	10 (dust) 5 (fume)
Arsenic (As)	7440-38-2	CG0525000	varies	C 0.002, Ca	0.01, Ca
Beryllium (Be)	7440-41-7	DS1750000	0.002, C 0.005	0.0005, Ca	0.002, Ca
Calcium (Ca)	--	--	varies	varies	varies
Cadmium (Cd)	7440-43-9	EU9800000	0.2, C 0.6 (dust) 0.1, C 0.3 (fume)	lowest feasible, Ca	0.01 (total), Ca 0.002 (respir.), Ca
Cobalt (Co)	7440-48-4	GF8750000	0.1	0.05	0.05 (dust, fume)
Chromium (II) (Cr)	22541-79-3	GB6260000	0.5	0.5	0.5
Chromium (III) (Cr)	16065-83-1	GB6261000	0.5	0.5	0.5
Chromium (VI) (Cr)	18540-29-9	GB6262000	C 0.1	0.001 (dust)	0.05 (soluble) 0.05 (insoluble), Ca
Copper (Cu)	7440-50-8	GL5325000	1 (dust, mists) 0.1 (fume)	1 (dust) 0.1 (fume)	1 (dust, mists) 0.2 (fume)
Iron (Fe)	1309-37-1	NO7400000	10 (dust, fume)	5 (dust, fume)	5 (fume)
Lithium (Li)	--	--	--	--	--
Magnesium (Mg)	1309-48-4	OM3850000	15 (dust) as oxide 5 (respirable)	10 (fume) as oxide	10 (fume) as oxide
Manganese (Mn)	7439-96-5	OO9275000	C 5	1; STEL 3	5 (dust) 1; STEL 3 (fume)
Molybdenum (Mo)	7439-98-7	QA4680000	5 (soluble) 15 (total insoluble) 5 (respirable insol.)	5 (soluble) 10 (insoluble)	5 (soluble) 10 (insoluble)
Nickel (Ni)	7440-02-0	QR5950000	1	0.015, Ca	0.05, Ca
Lead (Pb)	7439-92-1	OF7525000	0.05	<0.1	0.05
Platinum (Pt)	7440-06-4	TP2160000	0.002	1 (metal)	1 (metal)
Selenium (Se)	7782-49-2	VS7700000	0.2	0.2	0.2
Tellurium (Te)	13494-80-9	WY2625000	0.1	0.1	0.1
Titanium (Ti)	7440-32-6	XR1700000	as TiO ₂ , 15	lowest feasible, Ca	10
TiO ₂	13463-67-7	XR2275000	as TiO ₂ , 5 (respirable)		
Thallium (Tl)	7440-28-0	XG3425000	0.1 (skin) (soluble)	0.1 (skin) (soluble)	0.1 (skin)
Vanadium (V)	7440-62-2	YW2400000	C 0.5 (respirable) as V ₂ O ₅	C 0.05	0.05 (respir.) as V ₂ O ₅
V ₂ O ₅	1314-62-1	YW1355000	C 0.1 (fume) as V ₂ O ₅		
Yttrium (Y)	7440-65-5	ZG2980000	1	1	1
Zinc (Zn)	1314-13-2	ZH4810000	5 (ZnO fume) 15 (ZnO dust) 5 (ZnO respirable)	5; STEL 10 (ZnO fume) 5; C 15 (ZnO dust)	5; STEL 10 (ZnO fume) 10 (ZnO dust)
Zirconium (Zr)	7440-67-7	ZH7070000	5	5, STEL 10	5, STEL 10

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TABLE 3. MEASUREMENT PROCEDURES AND DATA^(a)

Element	Wavelength (nm)	Instrumental LOD (ng/mL)	Sensitivity (Intensity/ µg/mL)	Recovery		Precision (S _r) (N = 3)	
				@ 2.5 µg/ filter ^(b)	@ 1000 µg/ filter	@ 2.5 µg/ filter	@ 1000 µg/ filter
Ag	328.3	26	0.65	111	91	0.02	0.075
Al	308.2	14	0.23	93	100	0.092	0.023
As	193.7	13	0.57	103	99	0.062	0.026
Be	313.0	1.5	1.29	107	90	0.040	0.034
Ca	315.9	10	0.49	99	95	0.036	0.014
Cd	226.5	1.6	0.83	107	99	0.032	0.020
Co	231.2	7.4	0.38	101	95	0.040	0.005
Cr	205.6	1.3	0.50	98	106	0.053	0.016
Cu	324.8	2.1	0.72	98	99	0.036	0.022
Fe	259.9	3.9	0.13	94	97	0.068	0.016
Li	670.8	2.8	0.48	89	95	0.171	0.043
Mg	279.6	24	0.22	105	106	0.084	0.027
Mn	257.6	0.4	0.74	84	93	0.062	0.035
Mo	281.6	7.0	0.18	94	88	0.023	0.049
Na	589.0	10	0.76	(c)	101	(c)	0.045
Ni	231.6	3.4	0.41	105	97	0.027	0.020
P	214.9	22	0.17	(c)	91	(c)	0.056
Pb	220.4	17	0.42	105	95	0.060	0.011
Pt	203.7	15	0.69	106	91	0.041	0.075
Se	190.6	21	0.28	105	97	0.068	0.049
Sn ^(d)	190.0	64	0.49	74	67	0.33	0.16
Te	214.3	29	0.41	102	94	0.050	0.063
Ti	334.9	1.2	0.55	96	108	0.051	0.029
Tl	190.9	17	0.22	103	99	0.043	0.017
V	310.2	3.2	0.88	99	94	0.043	0.014
W ^(d)	207.9	13	2.58	35	23	0.053	0.60
Y	371.0	0.8	2.35	99	100	0.015	0.013
Zn	213.9	0.6	0.60	101	94	0.013	0.013
Zr	339.2	1.9	0.88	75	98	0.049	0.008

(a) Values reported were obtained with a Jarrell-Ash Model 1160 ICP; performance may vary with instrument and should be independently verified.

(b) 2.5 µg/filter corresponds to 5 µg/m³ for a 500-L air sample.

(c) Blank levels too high to make accurate determinations.

(d) Qualitative only because of low recovery.

APPENDIX - MICROWAVE DIGESTION FOR LEAD IN PAINT CHIPS (AND OTHER MATRICES)

This procedure is an alternative to the procedure presented in the Sample Preparation section of this method. It provides a rapid, complete acid digestion prior to analysis by flame atomic absorption (FAA), heated graphite furnace atomic absorption (HGFAA), and inductively coupled plasma spectroscopy (ICP) [10].

Apparatus and Material[11-16]

1. Microwave apparatus requirements:
 - a. The microwave unit provides programmable power with a minimum of 574 W and can be programmed to within ± 10 W of the required power.
 - b. The microwave unit cavity is corrosion resistant as well as ventilated. All electronics are protected against corrosion for safe operation.
 - c. The system requires Teflon PFA digestion vessels (120-mL capacity) capable of withstanding pressures up to 7.5 ± 0.7 atm (110 ± 10 psi) and capable of controlled pressure relief at pressures exceeding 7.5 ± 0.7 atm (110 ± 10 psi).
 - d. A rotating turntable is employed to ensure homogeneous distribution of microwave radiation within the unit. The speed of the turntable should be a minimum of 3 rpm.
 - e. A safety concern relates to the use of sealed containers without pressure relief valves in the unit. Temperature is the important variable controlling the reaction. Pressure is needed to attain elevated temperatures but must be safely contained [12].
 - f. Polymeric volumetric ware in plastic (Teflon or polyethylene), 50- or 100-mL capacity.
 - g. Disposable polypropylene filter funnel.
 - h. Analytical balance, 300-g capacity, and minimum ± 0.001 g.

Reagents

1. Nitric acid, concentrated, spectroscopy grade.
2. Reagent Water. Reagent water shall be interference free. All references to water in the method refer to reagent water that meets the ASTM Type 2 standard.

Procedure

1. Calibration of Microwave Equipment.

Calibrate microwave equipment in accordance with manufacturer's instructions. If calibration instructions are not available, see EPA Method 3051 [11].
2. All digestion vessels and volumetric ware must be carefully acid washed and rinsed with reagent water. All digestion vessels should be cleaned by leaching with hot (1:1) nitric acid for a minimum of fifteen minutes, rinsed with reagent water, and dried in a clean environment.
3. Sample Digestion
 - a. Tare the Teflon PFA digestion vessel.
 - b. Weigh out 0.1 g paint chip sample to the nearest 0.001 g into the tared Teflon PFA sample vessel. With large paint chip samples, measure out a 2 cm piece, weigh to the nearest 0.001 g, and quantitatively transfer it to the vessel.
 - c. Add 5.0 ± 0.1 mL concentrated nitric acid to the sample vessel in a fume hood. If a vigorous reaction occurs, allow the reaction to stop before capping the vessel. Cap the vessel and torque the cap to 12 ft-lb (16 N-m) according to the manufacturer's directions. The sample vessel may be connected to an overflow vessel using Teflon PFA connecting tubes. Place the vessels in the microwave carousel. Connect the overflow vessels to the center well of the unit.
 - d. Place the vessels evenly distributed in the turntable of the microwave unit using groups of two, six, or 12 sample vessels. Any vessels containing 5 mL of nitric acid for reagent blank purposes are counted as sample vessels. When fewer than the recommended number of samples are to be digested, i.e., three samples plus one blank, the remaining vessels should be filled with 5 mL of nitric acid to achieve the full complement of vessels. This provides an energy balance since the microwave power absorbed is proportional to the total mass in the cavity [14]. Irradiate each group of samples to achieve a temperature of 180°C in five minutes at a pressure of 50 psi. Continue to irradiate to achieve a temperature of 180°C at 100 psi after 25 minutes. Continue

digestion for five minutes. A sample digestion program for 12 samples is presented in the following table.

PROGRAM VARIABLES FOR PAINT CHIPS SAMPLE DIGESTION WITH NITRIC ACID

Stage	(1)	(2)	(3)
Power	90%	90%	0%
Pressure, psi	50	100	0
Run Time, min	10:00	20:00	05:00
Time @ P, min	05:00	15:00	00:00
Temperature	180°C	180°C	0°C
Fan Speed	100%	100%	100%
Number of Vessels:	12		
Liquid Volume per Vessel:	5 mL		
Sample Weight:	0.1 g		

If the analyst wishes to digest other than two, six, or 12 samples at a time, use different values of power as long as they result in the same time and temperature conditions.

- e. At the end of the microwave program, allow the vessels to cool for a minimum of five minutes before removing them from the microwave unit. If a loss of sample is detected (e.g., material in overflow collection vessel, liquid outside liner), determine the reason for the loss (e.g., loss of vessel seal integrity, use of a digestion time longer than 30 minutes, too large a sample, or improper heating conditions). Once the source of the loss has been corrected, prepare a new sample beginning at Section 2. If insufficient material is available for reanalysis, dilute remaining digestate and note that some sample loss may have occurred.
- f. Uncap and vent each vessel in a fume hood. Add 20 mL reagent water, then reseal vessels and shake to mix thoroughly. Transfer the sample to an acid-cleaned polyethylene bottle. If the digested sample contains particulates which may clog nebulizers or interfere with injection of the sample into the instrument, allow the sample to settle or filter it:

Settling: Allow the sample to stand until the supernatant is clear (usually, overnight is sufficient). If it does not clear, filter the sample.

Filtering: The filtering apparatus must be thoroughly precleaned and rinsed with dilute nitric acid. Filter the sample through quantitative filter paper into a second acid-cleaned container.

The digestate is now ready for analysis for elements of interest using the appropriate method.

4. Calculations: Report the concentrations based on the actual weight of the original sample.

PARTICULATES NOT OTHERWISE REGULATED, TOTAL

0500

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DEFINITION: total aerosol mass CAS: NONE RTECS: NONE

METHOD: 0500, Issue 2

EVALUATION: FULL

Issue 1: 15 February 1984

Issue 2: 15 August 1994

OSHA : 15 mg/m³
 NIOSH: no REL
 ACGIH: 10 mg/m³, total dust less than
 1% quartz

PROPERTIES: contains no asbestos and quartz
 less than 1%

SYNONYMS: nuisance dusts; particulates not otherwise classified

SAMPLING		MEASUREMENT	
SAMPLER:	FILTER (tared 37-mm, 5-µm PVC filter)	TECHNIQUE:	GRAVIMETRIC (FILTER WEIGHT)
FLOW RATE:	1 to 2 L/min	ANALYTE:	airborne particulate material
VOL-MIN:	7 L @ 15 mg/m ³	BALANCE:	0.001 mg sensitivity; use same balance before and after sample collection
-MAX:	133 L @ 15 mg/m ³	CALIBRATION:	National Institute of Standards and Technology Class S-1.1 weights or ASTM Class 1 weights
SHIPMENT:	routine	RANGE:	0.1 to 2 mg per sample
SAMPLE STABILITY:	indefinitely	ESTIMATED LOD:	0.03 mg per sample
BLANKS:	2 to 10 field blanks per set	PRECISION (\bar{S}_r):	0.026 [2]
BULK SAMPLE:	none required		
ACCURACY			
RANGE STUDIED:	8 to 28 mg/m ³		
BIAS:	0.01%		
OVERALL PRECISION (\bar{S}_{rt}):	0.056 [1]		
ACCURACY:	± 11.04%		

APPLICABILITY: The working range is 1 to 20 mg/m³ for a 100-L air sample. This method is nonspecific and determines the total dust concentration to which a worker is exposed. It may be applied, e.g., to gravimetric determination of fibrous glass [3] in addition to the other ACGIH particulates not otherwise regulated [4].

INTERFERENCES: Organic and volatile particulate matter may be removed by dry ashing [3].

OTHER METHODS: This method is similar to the criteria document method for fibrous glass [3] and Method 5000 for carbon black. This method replaces Method S349 [5]. Impingers and direct-reading instruments may be used to collect total dust samples, but these have limitations for personal sampling.

EQUIPMENT:

1. Sampler: 37-mm PVC, 2- to 5- μ m pore size membrane or equivalent hydrophobic filter and supporting pad in 37-mm cassette filter holder.
2. Personal sampling pump, 1 to 2 L/min, with flexible connecting tubing.
3. Microbalance, capable of weighing to 0.001 mg.
4. Static neutralizer: e.g., Po-210; replace nine months after the production date.
5. Forceps (preferably nylon).
6. Environmental chamber or room for balance (e.g., 20 °C \pm 1 °C and 50% \pm 5% RH).

SPECIAL PRECAUTIONS: None.**PREPARATION OF FILTERS BEFORE SAMPLING:**

1. Equilibrate the filters in an environmentally controlled weighing area or chamber for at least 2 h.
NOTE: An environmentally controlled chamber is desirable, but not required.
2. Number the backup pads with a ballpoint pen and place them, numbered side down, in filter cassette bottom sections.
3. Weigh the filters in an environmentally controlled area or chamber. Record the filter tare weight, W_1 (mg).
 - a. Zero the balance before each weighing.
 - b. Handle the filter with forceps. Pass the filter over an antistatic radiation source. Repeat this step if filter does not release easily from the forceps or if filter attracts balance pan. Static electricity can cause erroneous weight readings.
4. Assemble the filter in the filter cassettes and close firmly so that leakage around the filter will not occur. Place a plug in each opening of the filter cassette. Place a cellulose shrink band around the filter cassette, allow to dry and mark with the same number as the backup pad.

SAMPLING:

5. Calibrate each personal sampling pump with a representative sampler in line.
6. Sample at 1 to 2 L/min for a total sample volume of 7 to 133 L. Do not exceed a total filter loading of approximately 2 mg total dust. Take two to four replicate samples for each batch of field samples for quality assurance on the sampling procedure.

SAMPLE PREPARATION:

7. Wipe dust from the external surface of the filter cassette with a moist paper towel to minimize contamination. Discard the paper towel.
8. Remove the top and bottom plugs from the filter cassette. Equilibrate for at least 2 h in the balance room.
9. Remove the cassette band, pry open the cassette, and remove the filter gently to avoid loss of dust.
NOTE: If the filter adheres to the underside of the cassette top, very gently lift away by using the dull side of a scalpel blade. This must be done carefully or the filter will tear.

CALIBRATION AND QUALITY CONTROL:

10. Zero the microbalance before all weighings. Use the same microbalance for weighing filters before and after sample collection. Maintain and calibrate the balance with National Institute of Standards and Technology Class S-1.1 or ASTM Class 1 weights.

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11. The set of replicate samples should be exposed to the same dust environment, either in a laboratory dust chamber [7] or in the field [8]. The quality control samples must be taken with the same equipment, procedures and personnel used in the routine field samples. The relative standard deviation calculated from these replicates should be recorded on control charts and action taken when the precision is out of control [7].

MEASUREMENT:

12. Weigh each filter, including field blanks. Record the post-sampling weight, W_2 (mg). Record anything remarkable about a filter (e.g., overload, leakage, wet, torn, etc.)

CALCULATIONS:

13. Calculate the concentration of total particulate, C (mg/m^3), in the air volume sampled, V (L):

$$C = \frac{(W_2 - W_1) - (B_2 - B_1) \cdot 10^3}{V}, \text{ mg}/\text{m}^3.$$

where: W_1 = tare weight of filter before sampling (mg)
 W_2 = post-sampling weight of sample-containing filter (mg)
 B_1 = mean tare weight of blank filters (mg)
 B_2 = mean post-sampling weight of blank filters (mg)

EVALUATION OF METHOD:

Lab testing with blank filters and generated atmospheres of carbon black was done at 8 to 28 mg/m^3 [2,6]. Precision and accuracy data are given on page 0500-1.

REFERENCES:

- [1] NIOSH Manual of Analytical Methods, 3rd ed., NMAM 5000, DHHS (NIOSH) Publication No. 84-100 (1984).
- [2] Unpublished data from Non-textile Cotton Study, NIOSH/DRDS/EIB.
- [3] NIOSH Criteria for a Recommended Standard ... Occupational Exposure to Fibrous Glass, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-152, 119-142 (1977).
- [4] 1993-1994 Threshold Limit Values and Biological Exposure Indices, Appendix D, ACGIH, Cincinnati, OH (1993).
- [5] NIOSH Manual of Analytical Methods, 2nd ed., V. 3, S349, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-C (1977).
- [6] Documentation of the NIOSH Validation Tests, S262 and S349, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-185 (1977).
- [7] Bowman, J.D., D.L. Bartley, G.M. Breuer, L.J. Doemeny, and D.J. Murdock. Accuracy Criteria Recommended for the Certification of Gravimetric Coal Mine Dust Personal Samplers. NTIS Pub. No. PB 85-222446 (1984).
- [8] Breslin, J.A., S.J. Page, and R.A. Jankowski. Precision of Personal Sampling of Respirable Dust in Coal Mines, U.S. Bureau of Mines Report of Investigations #8740 (1983).

METHOD REVISED BY:

Jerry Clere and Frank Hearl, P.E., NIOSH/DRDS.

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Reporting Format

- Field notebook
- Air monitoring
- Field data sheets
- Trip report
- Instrument datalogger

Table 6: Air Sampling Methods

Contaminant	NIOSH, OSHA or EPA Sample Method	Sample Media	Sample Pump	Sample Flow Rate
Lead	NIOSH 7300	37 mm 0.8µm Mixed Cellulose Ester Filter	Gillian HFS 113 or equivalent	1 L/min to 4 L/min
Particulates not otherwise Regulated; Total	NIOSH 0500	Tared 37-mm 5-µm PVC filter	Gillian HFS 113 or equivalent	1 to 2 L/min

TICK BITES and LYME DISEASE
SAFETY OFFICERS' GUIDANCE and REPORTING PROCEDURES
(Revised 5 April 1999)

Transmission of Lyme Disease

Lyme disease is caused by the transmission of a bacterium by a specific type of tick.

The deer tick is much smaller than a common dog or cattle tick (about 2 mm).

Not all deer ticks are infected with the bacterium causing Lyme disease.

Ticks do not jump or fly. They crawl onto their host from the tips of grasses and shrubs, or from the forest floor. Most cases of Lyme disease occur between April and October when more time is spent outdoors during work or recreational activities. The Center for Disease Control (CDC) indicates that most cases of Lyme disease occur near the home.

Ticks feed on blood by embedding their mouth parts under the skin of their host. A complete feeding can take several days, and an infected tick must be embedded for at least 24 hours to pass on the bacterium.

The CDC has identified the following states as having a higher risk for the occurrence of Lyme disease:

California	New Jersey
Connecticut	New York
Maryland	Pennsylvania
Massachusetts	Rhode Island
Minnesota	Wisconsin

Even in the above states, the number of cases of Lyme disease is relatively low. Available data for the past three years does not show any cases of Lyme disease at WESTON.

Symptoms of Lyme disease

Early symptoms may include fatigue, chills, arthritis-like pain in the joints or muscles, headache, and a spreading "bull's-eye" rash. The rash usually appears from one to three days after a bite by an infected tick. The most common locations of tick bites are the thighs, groin, trunk or armpits.

The center of the rash usually clears up as the rash grows, giving it a characteristic "bull's-eye" appearance. The rash will usually disappear in two to four weeks with or without treatment. It is possible for a tick bite to produce a rash and not develop Lyme disease. Some people have an allergic reaction to tick saliva.

The employee should not be directed to a panel occupational physician until the rash is at least two inches in diameter. Proper diagnosis is difficult prior to this, because the blood test will generally not be positive until two to four weeks after the attachment by an infected tick.

It is never in a person's best interest to treat for Lyme disease unless the disease has actually been diagnosed. Antibiotics taken in the first two to four weeks may eliminate the ability of the blood test to accurately diagnose the disease. Antibiotics can also cause side effects, mask other lenses or cause life-threatening allergic reactions.

Reporting Procedures

Safety Officers must encourage proper reporting. Employees who work outside should carefully inspect their body and clothing for tick every day. Employees must report any embedded ticks to their Site Safety Officer (SSO) or direct supervisor.

Any attached ticks should be carefully removed with fine tipped tweezers. Grasp the tick firmly as close to the skin as possible and pull straight back without crushing or twisting the tick. The employee should wash his or her hands and dab the area with antiseptic.

It is not necessary to save the tick. Testing is not routinely done, and most labs are not set up to perform analysis on a commercial basis.

Initial Report of a Tick Bite

1) Employee does not exhibit symptoms:

When an employee is bitten by a tick and does not exhibit symptoms of Lyme disease, a ☐ HYPERLINK "\\CORPLAN01\\USER1\\HOME\\SHARED\\FORMS\\Notice.doc" ☐ of Near-Incident must be completed and sent to the Risk Management Department (RMD) and other appropriate parties within 24 hours.

Employees with concerns should contact WESTON's Medical Consultant at Continuum at 1-800-229-3674.

2) Employee does exhibit symptoms:

When an employee is bitten by a tick and does exhibit symptoms of Lyme disease, a ☐ HYPERLINK "\\CORPLAN01\\USER1\\HOME\\SHARED\\FORMS\\Notice.doc" ☐ of Incident must be completed and sent to RMD and other appropriate parties within 24 hours.

The Safety Officer must be notified immediately if symptoms develop at the site of a previously reported tick bite. The initial ☐ HYPERLINK

"\\CORPLAN01\\USER1\\HOME\\SHARED\\FORMS\\Notice.doc" ☐

Incident must be updated and sent to RMD within 24 hours.

APPOINTMENT WITH THE OCCUPATIONAL PHYSICIAN

(After the red spot is at least two inches in diameter)

The employee should be referred to the occupational physician. Whenever possible, the employee should be accompanied by the SSO or other WESTON personnel.

The employee should forward the Return to Work form to RMD at 91S.

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Contact RMD at (610) 701-7413 if there are any questions concerning incident or near-incident reporting.

Remember that prevention, including avoiding tick-infested areas whenever possible, wearing light-colored clothing with long sleeves, tucking pant legs into socks or boots, and spraying insect repellent onto clothes and exposed skin other than the face, is the best protection against Lyme disease.

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HEARTSAVER AED

American Heart
Association
Fighting Heart Disease and Stroke



MARK LUCY

has successfully completed the national cognitive and skills evaluations in accordance with the curriculum of the American Heart Association for the Heartsaver Automated External Defibrillation Program.

NOV. 1999
Issue Date

NOV. 2001
Recommended Renewal Date

CTC RECOMMENDED DATE NOV. 2000

National Registry
of
EMERGENCY MEDICAL TECHNICIANS
hereby certifies that

Mark A. Lucy
HAVING FULFILLED THE PRESCRIBED REQUIREMENTS AND
SATISFACTORILY PASSING THE WRITTEN AND PRACTICAL
EXAMINATION IS DULY REGISTERED AS AN
EMERGENCY MEDICAL TECHNICIAN
IN THE CLASSIFICATION LISTED BELOW

REGISTRY NO.	EXPIRATION DATE	CLASSIFICATION
B1224205	3/31/01	EMT - Basic

USE THIS NUMBER ON ALL
CORRESPONDENCE TO THE
NATIONAL REGISTRY.

William E. Brown
EXECUTIVE DIRECTOR

NR/EMT
1970-1999

STATE OF DELAWARE
The State Fire Prevention Commission
Certifies That

MARK LUCY
has been examined and has been found
to meet the requirements to be certified as a
DELAWARE EMERGENCY MEDICAL TECHNICIAN
IN THE CLASSIFICATION LISTED BELOW

IDENTIFICATION NO.	EXP. DATE	CLASSIFICATION
268261	3/31/01	Basic

Charles E. Brown
CHAIRMAN FIRE PREVENTION COMMISSION

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SCOPE OF WORK (E.M.T.)

The scope of work for the site E.M.T. shall include, but is not limited to the taking of a set of vitals (Blood Pressure, Heart Rate, Body Temperature) of any individual who shall enter and exit the "HOT ZONE". The scope of work also shall include any action deemed necessary by the site E.M.T., RM and OSC in an emergency situation.

Documentation on all vitals shall also be done by the site E.M.T. and kept on file in the R.M. office trailer.

TABLE II—RESPIRATORY PROTECTION FOR LEAD AEROSOLS

Airborne concentration of lead or condition of use	Required respirator ¹
Not in excess of 0.5 mg/m ³ (10X PEL)	Half-mask, air-purifying respirator equipped with high efficiency filters. ^{2,3}
Not in excess of 2.5 mg/m ³ (50X PEL)	Full facepiece, air-purifying respirator with high efficiency filters. ³
Not in excess of 50 mg/m ³ (1000X PEL)	(1) Any powered, air-purifying respirator with high efficiency filters; ³ or (2) Half-mask supplied-air respirator operated in positive-pressure mode. ²
Not in excess of 100 mg/m ³ (2000X PEL)	Supplied-air respirators with full facepiece, hood, helmet, or suit, operated in positive pressure mode.
Greater than 100 mg/m ³ , unknown concentration or fire fighting	Full facepiece, self-contained breathing apparatus operated in positive-pressure mode.

¹Respirators specified for high concentrations can be used at lower concentrations of lead.

²Full facepiece is required if the lead aerosols cause eye or skin irritation at the use concentrations.

³A high efficiency particulate filter means 99.97 percent efficient against 0.3 micron size particles.

(ii) The employer shall provide a powered, air-purifying respirator in lieu of the respirator specified in Table II whenever:

(A) An employee chooses to use this type of respirator; and

(B) This respirator will provide adequate protection to the employee.

(iii) The employer shall select respirators from among those approved for protection against lead dust, fume, and mist by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11.

(3) **Respirator usage.** (i) The employer shall assure that the respirator issued to the employee exhibits minimum facepiece leakage and that the respirator is fitted properly.

(ii) Employers shall perform either quantitative or qualitative face fit tests at the time of initial fitting and at least every six months thereafter for each employee wearing negative pressure respirators. The qualitative fit tests may be used only for testing the fit of half-mask respirators where they are permitted to be worn, and shall be conducted in accordance with Appendix D. The tests shall be used to select facepieces that provide the required protection as prescribed in Table II.

(iii) If an employee exhibits difficulty in breathing during the fitting test or during use, the employer shall make available to the employee an examination in accordance with paragraph (j)(3)(i)(C) of this section to determine

whether the employee can wear a respirator while performing the required duty.

(4) **Respirator program.** (i) The employer shall institute a respiratory protection program in accordance with 29 CFR 1910.134 (b), (d), (e) and (f).

(ii) The employer shall permit each employee who uses a filter respirator to change the filter elements whenever an increase in breathing resistance is detected and shall maintain an adequate supply of filter elements for this purpose.

(iii) Employees who wear respirators shall be permitted to leave work areas to wash their face and respirator facepiece whenever necessary to prevent skin irritation associated with respirator use.

(g) **Protective work clothing and equipment.** (1) **Provision and use.** If an employee is exposed to lead above the PEL, without regard to the use of respirators or where the possibility of skin or eye irritation exists, the employer shall provide at no cost to the employee and assure that the employee uses appropriate protective work clothing and equipment such as, but not limited to:

(i) Coveralls or similar full-body work clothing;

(ii) Gloves, hats, and shoes or disposable shoe covers; and

(iii) Face shields, vented goggles, or other appropriate protective equipment which complies with §1910.133 of this Part.

(2) **Cleaning and replacement.** (i) The employer shall provide the protective clothing required in paragraph (g)(1) of this section in a clean and dry condition at least weekly, and daily to employees whose exposure levels without regard to a respirator are over 200 µg/m³ of lead as an 8-hour TWA.

(ii) The employer shall provide for the cleaning, laundering, or disposal of protective clothing and equipment required by paragraph (g)(1) of this section.

(iii) The employer shall repair or replace required protective clothing and equipment as needed to maintain their effectiveness.

(iv) The employer shall assure that all protective clothing is removed at the completion of a work shift only in change rooms provided for that purpose as prescribed in paragraph (i)(2) of this section.

(v) The employer shall assure that contaminated protective clothing which is to be cleaned, laundered, or disposed of, is placed in a closed container in the change-room which prevents dispersion of lead outside the container.

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